

Naval Surface Fire Support: Not Just a Substitute for Naval Gunfire!

CSC 1997

Subject Area - Artillery

EXECUTIVE SUMMARY

Title: Naval Surface Fire Support: Not Just a Substitute for Naval Gunfire!

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Thesis: This paper examines the Naval Surface Fire Support (NSFS) concept from a requirements perspective in an attempt to answer the question: Is NSFS a viable supporting concept for Operational Maneuver From the Sea (OMFTS)?

Discussion. The historical relevance of naval gunfire (NGF) connotes overwhelming firepower used to subdue formidable land defenses in support of the of amphibious forces. NGF achieved prominence in support of amphibious operations during World War II. In the intervening years, NGF capability steadily declined without significant improvement or change in doctrine, though the nation's attention to power projection has increased.

The uncertainty associated with the Post Cold War era challenges military strategists to determine an appropriate and justifiable force structure within the United States. The Department of Defense will continue to downsize while the need to credibly project power will remain constant or increase. Without a clear threat, many perceive an opportunity to fix domestic ills through downsizing defense. The current National Security Strategy is one of "*Engagement and Enlargement*."¹ Recent experience indicates limited military intervention, or Military Operations Other Than War (MOOTW), will define the nature of conflict for the near future to quell conflicts before they blossom into global conflagrations that threaten the status quo.

Military visionaries are challenged to develop more efficient war fighting concepts to meet both national desires and the ambiguity of future threats. OMFTS reflects an innovative approach that meets the desires for a smaller military while maintaining the ability to project sea-borne power in support of the full range of military operations. The NSFS concept merges the economies of advanced technology and sea-based firepower to support OMFTS. NSFS is much more than NGF and affords a flexibility that accommodates both MOOTW and war.

¹ William J. Clinton, President of the United States. *A National Security Strategic of Engagement and Enlargement*, (Washington DC: U.S. Government Printing Office, Feb 1996).

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1997		2. REPORT TYPE		3. DATES COVERED 00-00-1997 to 00-00-1997	
4. TITLE AND SUBTITLE Naval Surface Fire Support: Not Just a Substitute for Naval Gunfire!				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Marine Corps, Command and Staff College, Marine Corps University, 2076 South Street, Marine Corps Combat Development Command, Quantico, VA, 22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 86	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Conclusion. NSFS is evolving at rapid pace and will field improvements concurrently with the other important OMFTS tools like the MV-22 Osprey, the Advanced Amphibious Assault Vehicle, and the Light Weight 155 millimeter Howitzer.

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PREFACE

Ever since World War II, Naval Gunfire (NGF) capability has steadily dwindled to a mere hint of the firepower used to subdue the Axis powers during World War II. The Iowa class battleships with their deadly 16" naval guns are effectively gone, for good this time, reserve status eloquence notwithstanding. The historical epitome of NGF, they are far too costly to upgrade to a level compatible with today's much more technically sophisticated surface combatants.¹ With their departure, many feel that NGF capability is effectively gone as well. The biggest naval gun in the Fleet today, the 5"/54, is considered inadequate to support a contemporary amphibious assault because of limited range and lethality. In contrast, amphibious operations are just as viable as ever. In fact, they form the foundation for evolving naval warfighting concepts like Operational Maneuver From the Sea (OMFTS).²

The Naval Surface Fire Support (NSFS) has replaced NGF. NSFS proposes to capitalize on technology and the combined firepower of variety of weapons to provide a complimentary sea-based fire support capability for OMFTS.³ For the very near future, NSFS is restricted to

¹ Department of the Navy, *Response to Questions from Mr. Bill Fallon, Military Liaison Attaché for Representative Dornan (R-Ca)*. These questions concerned the viability of returning battleships to active status to provide more effective NSFS," October, 1995. This is not the first document to sight the final retirement of the battleships, however, it is one of the more recent examples of the questions typically posed by Congress regarding the Navy's efforts to rejuvenate NGF. Battleships are a particularly sore point because they are commonly perceived as a highly capable, existing asset, that the Navy seems bent on ignoring in favor of risky, costly, and potentially time consuming new development. Battleships are prohibitively costly to maintain and upgrade, particularly in an era of downsizing. To activate one battleship costs anywhere from \$115M to \$210M depending on whether overhaul is included. This cost does not include upgrading C2 systems to make them compatible with current C4I systems, nor does it include manpower, and day to day operational maintenance costs (O&M).

² C.C. Krulak, General, USMC, Commandant of the Marine Corps, *Operational Maneuver From the Sea*. Headquarters, Marine Corps, Washington DC. Summer 1996. Both a future warfighting concept and corresponding road map to get there.

³ Chief of Naval Operations Executive Board (CEB), *Naval Surface Fire Support*, A briefing on NSFS provided to the Chief of Naval Operations (CNO) by the Director, Surface Warfare Plans, Programs and Requirements Branch (N863), 3 October 1994. This was the first time NSFS was formally briefed to the CNO. NSFS seemed to gain momentum at this point. In the following 12 months, the Marine Corps developed the "near term" requirement, and the Navy developed Operational Requirements Documents (ORDs) for the Extended Range Guided Munitions (ERGM) and the 5"/62 naval gun modification. This brief marked the point at which the NSFS "concept" transitioned into the NSFS "program."

the 5"/54 naval gun, tactical aviation, and the possible use of Navy land attack missiles.⁴

Massing firepower or combining the effects of a variety of weapons is not a new concept.

America's naval forces perfected this at least as far back as World War II. **NSFS is unique in that it implies an integrated system of systems combining the firepower of a variety of sea-based weapons enhanced with precision guidance, near real time targeting, coordinated engagement, and damage assessment.** This permits a more effective and efficient use of supporting arms in the future arena of likely conflicts.

There are a number of tempting questions posed by the NSFS concept. Are there applicable historical parallels? What is influencing the development of NSFS? Does NSFS represent a realistic derivation of future requirements in light of the Post-Cold War world or is it merely an ideological application of advanced technology? Is the development of NSFS typical of previous warfighting enhancements like the tank or a convulsion characteristic of the current transition into the Information Age? What does OMFTS imply for NSFS? Will its role vary from that NGF?

This paper examines the generation of the Naval Surface Fire Support concept from a requirements based perspective in an attempt to answer the question: Is NSFS a viable supporting concept for Operational Maneuver From the Sea?

Chapter One examines the use of NGF since World War II to determine whether there are applicable conditions that contributed to the recent transition to NSFS. Chapter Two discusses NSFS within the context of the post Cold War era. Chapter Three explores the recent derivation of the NSFS requirement and how OMFTS provides a framework for the current NSFS acquisition program. Chapter Four analyzes the NSFS program including future

⁴ Institute for Defense Analyses (IDA), *Assessment of Alternative Ship-to-Shore Fire Support Systems*, June 1993, IDA Report R-387, 23, and Donald M. Weller, MGEN USMC (Ret.). *Naval Gunfire Support of Amphibious Operations: Past, Present and Future*. (Arlington, VA: Universal Systems, Inc.) A Study prepared for Naval Sea Systems Command (NAVSEA) and Headquarters U. S. Marine Corps. October, 1977, 9, 48. The Mk45 5"/54 has a maximum *effective* range of between three to five NM and a maximum range of 13 NM. The nominal standoff range for OMFTS is 25 NM. Tactical aviation and cruise missiles are potential gap fillers. Here after this study is referred to as "IDA."

intentions to identify potential shortfalls. Chapter Five provides a few conclusions, in an effort to determine the suitability of NSFS as a viable supporting capability for OMFTS.

A variety of sources were used for this paper. These fall into five major categories: doctrine, assessments, requirements, programming and acquisition, and “other”. The first four are exclusively associated with NSFS and capture the flow from concept to capability. “Other” refers to a variety of essays and articles discussing the broader aspects of the Post Cold War Era.

These serve as a backdrop for new doctrinal publications like OMFTS and provide rounded context with which to examine the suitability of NSFS. Most sources were official Navy and Marine Corps documents drafted within the last five years. The bulk of these are assessments performed by government laboratories in response to NSFS issues raised by OMFTS. The Center for Naval Analyses (CNA) performed a key role in this respect. The Marine Corps, the primary beneficiary of NSFS, developed most of the requirement documentation. Requirements subsequently provided justification for the Navy to proceed with programming and acquisition.

CHAPTER 1

HISTORICAL PERSPECTIVE

NGF, the precursor to NSFS, played an important role in the wars of the United States (U.S.) particularly in regard to the conduct of amphibious operations. Although, there are prior instances, World War II hallmarks the rise of the mighty U.S. fleets that ultimately formed the foundation for the Nation's current superpower status. It refined the role of NGF that remained steadfastly in place until recently.⁵

Naval guns were originally developed to engage other ships. During World War II, they were also found to be exceptionally effective against land targets, particularly in support of the amphibious operations that characterized the Pacific theater. Over the course of the proceeding years, the characteristics of these guns never changed significantly.⁶ The obvious question is why? Was it because the NGF weapons systems achieved perfection and never needed improvement, or was it because the nature of America's conflicts changed?

Pre-World War II Doctrine

Pre-World War II amphibious doctrine developed jointly by the Navy and the Marine Corps identified a role for NGF; however, the Navy was still focused on the adversary fleet.

⁵ Donald M. Weller, MGEN USMC (Ret.). *Naval Gunfire Support of Amphibious Operations: Past, Present and Future*. (Arlington , VA: Universal Systems, Inc.) A Study prepared for Naval Sea Systems Command (NAVSEA) and Headquarters U. S. Marine Corps. October, 1977, Preface, 47. Weller comments that the only improvement in NGF since World War II was the Mk45 5"/54. Moreover, he notes that the 5"/54 has a maximum *effective* range of between 3 to 5 nautical miles and a maximum range of 13 NM which does little good in light of the experiences of more recent conflicts like Korea and Vietnam.

⁶ Weller, 7-10. There are probably other studies, but there are inevitable time limits to research. Major General Weller's assessment seems characteristic of subsequent studies wherein he notes that as of 1977, the only naval gun improvement has been the 5"/54. These days, represented as they are by difficulty in predicting the threat, tend to encourage reliance on the past to come up with solutions, e.g. the number of battleships in support of the Okinawa landing.

This relegated NGF to a subsidiary role based more on whether the situation made it convenient than any concerted desire to facilitate amphibious operations. Doctrine stressed the avoidance of land based or near land based threats like mines and coastal defense guns to the greatest possible extent in order to surmount difficulties in specifically identifying the extent of these threats for any particular situation. As a result, counter-battery fire in support of amphibious operations had to be conducted at maximum range while maneuvering at high speed.⁷ In addition, the larger focus on the adversary fleet implied a need to frugally employ ammunition so as to conserve it for surface engagements. The role of NGF was also influenced by the characteristics of naval guns. Naval gunnery, characterized by relatively flat trajectory and high velocity, was originally designed to engage other ships at relatively close ranges⁸ operating on a uniform or flat surface. The irregularities of land tended to limit effectiveness to targets that were not masked by terrain, typically those along the coastline. Improvements in fusing and munitions variety mitigated, but never completely solved this issue.

During World War II, NGF ships frequently violated pre-war doctrine both in terms of standoff ranges and in numbers of ships allocated to NGF support. NGF ships were renown for closing to within several thousand meters of shore targets, literally within the purview of the human eyeball, to engage particularly persistent targets. The battleships *Nevada*, *Idaho*, and *Tennessee* closed to within one and half nautical miles (NM) of the eastern landing beaches on Iwo Jima to engage targets.⁹ In 1944, during the Marianas Campaign, the availability of dedicated NGF was staggering. On Saipan seven battleships, 11 cruisers, and 26 destroyers were specifically dedicated to D-day preparation fires. At any one time three to four battleships and twice as many cruisers and destroyers were usually available to continuously bombard the island. Similar numbers of ships were allocated to subsequent landings on Tinian and Guam.

⁷ Weller, 12.

⁸ Weller, 47.

⁹ Weller, 87.

On Guam, preliminary D-day NGF bombardment lasted for 13 days. Once ashore, two or three destroyers were provided in direct support of each infantry battalion. Other battleships and cruisers remained in general support and concentrated on deep fires.¹⁰

World War II refined and validated the effectiveness of NGF and subsequently modified doctrine. The huge scope of the conflict along with two large and potent adversaries in two geographically distinct and extensive theaters separated by wide expanses of ocean,¹¹ created a unique stimulus that drove changes. Each adversary tailored defensive strategies in accordance with respectively unique geographical features. Within this context, both the role and capability of NGF significantly expanded, thus creating a massive capability by the end of the war. However, following the war, without comparable stimulus, this capability steadily declined.

World War II: European Theater

The nature of the European theater emphasized the use of NGF in an interdiction role. The large land masses of Sicily, Italy, and Europe proper offered a great deal of flexibility in the selection of landing sites and limited the Axis' ability to defend every conceivable landing area. The answer to defense entailed a combination of fortified beach positions along the more lucrative landing areas. These were relatively easy to determine because of generally rugged coastlines. Highly mobile counterattack forces were positioned inland to respond to the main landing once it was identified to drive the attacker back into the sea.¹² NGF interdiction proved instrumental on a number of occasions, particularly in Sicily and Italy where immediately following Allied landings Axis armored forces counterattacked. Though the role of NGF included the destruction and/or neutralization of beach defenses to accommodate the lodgment,

¹⁰ Philip A. Crowl, *Campaign in the Marianas - The War in the Pacific - United States Army in World War II*, (Washington DC: Office of the Chief of Military History, Department of the Army, 1959), 321.

¹¹ Weller, 48-49.

¹² Weller, 3-12.

the lesson of the European theater was the usefulness of NGF interdiction against the mobile defense.

World War II: Pacific Theater

In contrast, the nature of the Pacific theater emphasized NGF bombardment to suppress and/or destroy the defense. The relative small land masses or islands that characterized the war in the Pacific, discouraged the mobile defense. Instead, the Japanese relied exclusively on heavily fortified beach defenses that included coastal guns, mines, and obstacles to preclude landing altogether.¹³ There are exceptions, like Okinawa where the Japanese waited until landing forces were ashore,¹⁴ but generally, the small size of island objectives precluded defense in depth. The predominant role of NGF was the destruction and/or neutralization of beach defenses to accommodate lodgment.

Korea to Present

During Korea, Vietnam, and Desert Storm, NGF interdiction proved the most useful role. Unlike World War II, these conflicts were not characterized by numerous opposed amphibious assaults. Amphibious operations were conducted on a much smaller scale, with the notable exception of the Inchon landing during Korea. None of these conflicts included opposed amphibious operations on par with World War II. However, rather than indicating a trend towards the limited usefulness of amphibious operations, Inchon demonstrated the effectiveness of the amphibious envelopment. In the future, the threat of this maneuver in 1991 would serve to pin down considerable Iraqi forces during Desert Storm.

¹³ Weller, 12.

¹⁴ Astor, Gerald. *Operation Iceberg*. New York: Donald I. Fine, Inc., 1995. 137-144.

All three conflicts started with a friendly lodgment ashore. This limited the need for pre-landing bombardment and contributed to the use of NGF for interdiction. As friendly forces maneuvered along coastal areas, they were supported by NGF. NGF was also extensively used to harass and interdict enemy coastal avenues of approach and lines of communication (LOCs).¹⁵ Despite the lack of massive amphibious assaults, adversaries still expended considerable resources on coastal defense to inhibit NGF interdiction campaigns.¹⁶

Coastal defense strategy changed significantly in 1991 during Desert Storm with the advent of the mobile anti-ship missile and the random seeding of mines. Though the Iraqis never successfully employed these missiles, the threat they posed influenced naval operations in the Gulf of Arabia. After observing the anti-ship missiles for awhile, most were determined to be inoperable or dummy sites. The random seeding of mines was taken more seriously and greatly influenced planning for amphibious operations. The validity of the mine threat had little or no impact. Planning had to assume a worst case scenario since initial reconnaissance was unable to determine whether the mines were seeded according to Soviet or U.S. doctrine. Initially, there was no discernible pattern to the mine fields.¹⁷ Naval strategy was understandably influenced by these threats and force protection dictated that ships remain further out at sea. As a result, the character of NGF interdiction changed. Longer ranges were now required in order to counter these threats.

In each of the major conflicts since Korea, the larger amphibious operations, though not on the scale of World War II, were associated with ongoing land campaigns. There was already a friendly lodgment ashore. Large scale amphibious assaults on par with World War II were not required. However, adversaries still adopted a coastal defensive strategy that focused on

¹⁵ Weller, 3-12.

¹⁶ Weller, 10-12.

¹⁷ Author, while serving as assistant Fire Support Officer (FSO) with the 5th Marine Expeditionary Brigade (MEB) during and as 11th Marine Expeditionary Unit (MEU) FSO following Desert Storm.

defending the water line. Mobile anti-ship missiles and mines represented the counter response to NGF interdiction and subsequently forced NGF ships further out to sea for survivability. The recurring theme carried over from World War II remained defense of the water line because it represents a critical vulnerability¹⁸ for a force attempting to project ground power ashore. Projecting ground power ashore exposes the landing force and its supporting ships to a variety of threats that the Navy is not ideally prepared to confront. OMFTS¹⁹ stresses the “seamless” transition or projection of power via maneuver that begins from over-the-horizon or beyond the range of current coastal defenses.

Relevant Parallels

There are several fundamental historical parallels to draw upon that suggest trends in NGF support that prove useful in broadening current NSFS perspectives. At the same time, it is somewhat contradictory to suggest that the past’s tools - the battleships, cruisers et al., are the exclusive answer to today’s evolving requirement however noteworthy their previous accomplishments.

The 5” caliber gun was deemed ineffective as a stand alone capability in support of amphibious operations as far back as World War II.²⁰ The 1994 NSFS Cost and Operational Effectiveness Analysis (COEA) also condemns the 5” caliber.²¹ Yet, ironically, the only

¹⁸ Joe Strange, *Perspectives on Warfighting Number Four: Centers of Gravity & Critical Vulnerabilities; Building on the Clausewitzian Foundation So that We can all Speak the same Language*, Marine Corps University, (Quantico: Marine Corps Association), 3.

¹⁹ Specifically, Operational Maneuver From the Sea (OMFTS) and Forward From the Sea (FFTS). See Bibliography.

²⁰ Weller, 6.

²¹ CNA. *NSFS COEA Final Report*. October 1994. CNR 210. 3-4.

enhancement to NGF capability in the intervening years has been the 5"/54 with its modest range and rate of fire improvements over the older 5"/38.²²

Compared to the current advent of precision guided munitions, the 5" gun is relatively inaccurate. During World War II, Korea, and Vietnam, the 5" gun with its relatively light warhead was rarely used to engage hard targets characteristic of coastal defenses because a direct hit was usually required to destroy or even neutralize the target for any meaningful period of time. Instead, the 5" gun proved of more use in engaging soft area targets where its high rate of fire combined with the range dispersion characteristic of naval guns laid down an area barrage similar to artillery.²³ The larger caliber guns, 8" and up, were more effective despite the fact that they were as inaccurate as the 5" and because of the collateral damage they caused.²⁴

Quantity or volume of fire is often confused with effectiveness. Ballistic NGF is inherently inaccurate. To acquire a direct hit on a vertical target of 30 by 12 feet at five NM required an average of 64 rounds. The same target at one and a half NM required four rounds. The effectiveness of NGF is clearly more a function of volume and collateral damage rather than direct hits. The scope of World War II yielded enough NGF ships to provide volume.²⁵ In the Pacific theater, U.S. forces steadily employed more NGF with each succeeding campaign. The Japanese did not remain idle either as they built stronger defenses that were able to withstand greater bombardment. This was a contest of who could apply the greater amount of force. The winner was the one who possessed the greater amount of resources.

²² Weller, 48. The 5"/38 had range of 9NM and fires 10 rounds per minute (rpm). The existing 5"/54 has a range of 13NM and fires 20 rpm with MK 45 Modification.

²³ Artillery is also an area fire weapon. It is rarely used to destroy armor or hard targets. However, it is used to suppress these types of targets while another means is used to destroy them. There is also a guided artillery projectile known as Copperhead.

²⁴ Weller, 6.

²⁵ Weller, 7, 50, 130. Weller briefly mentions the role of dedicated aerial spotter squadrons established during and subsequently disbanded after WWII. Dedicated aerial spotting assets offer a potential solution to the current long range targeting dilemma.

Ranges up to 20 NM were the norm in World War II, Korea, and Vietnam. Desert Storm increased these ranges considerably. The variables that drove these ranges included the lack of accurate coastal hydrography, the coastal defense threat, mines, and the long range interdiction of counterattacking forces.²⁶ These variables are still relevant today. The Japanese and Germans extensively employed coastal defense guns, the precursor to land based anti-ship missiles, to protect landing approaches. The Koreans and Vietnamese also extensively employed coastal guns to limit naval ships engaged in interdicting their lines of communication (LOCs).²⁷ Today, coastal defense threats are mobile, cheaper, and more sophisticated. Moreover, mines are more of a potential show stopper today.²⁸ During World War II, there were enough mine sweepers to clear massive areas in a relatively short period of time. In 1944, 2500 square miles were “sanitized” in the Ryukyus prior to the Okinawa campaign over a four day period.²⁹ Unfortunately, the requirement for surprise, with the exception of Normandy, did not hold the precedence it does today. These issues argue for greater NGF range .

Contrary to conventional perception, the emphasis of NGF has steadily transitioned from landing area preparation and on-call fires in support of the initial landing waves to interdiction of counterattacking forces. This is due to several factors. First, the defense has recognized the vulnerability of fixed coastal defenses, no matter how well fortified. There are drawbacks to near invulnerable fortifications: (1) they are usually fixed and can be bypassed, and (2) they drain resources. A simple cost-benefit analysis suggests it is probably not worth the effort.

²⁶ Weller, 3-112, 130. This tends to further emphasize the confusion over just what exactly are the requirements for NSFS. Weller’s 1977 study includes several postulated requirements regarding range and lethality that are very similar to the “conclusions” presented in current government studies such as the NSFS COEA. Government and defense contractor studies seem to avoid the term “requirements” though these studies seem to have been instrumental in determining current requirements.

²⁷ Weller, 11.

²⁸ Author while serving as an action officer (AO) in N85, with some cognizance over very shallow water mine threat initiatives as one of the MCAC (multi-purpose, craft air cushion) AOs.

²⁹ Gerald Astor, *Operation Iceberg*, (New York: Donald I. Fine, Inc., 1995), 49.

Mines present the greatest obstacle because they are inexpensive, easily emplaced, and very difficult to detect and neutralize. Moreover, an adversary does not have to expend a lot of resources to present a formidable mine threat. One detected mine will give pause to any amphibious assault, particularly in an era of few multi-mission ships where the risk associated with the loss of one ship can be nearly disastrous. Consider the uproar created by the two ships that hit roving mines during Desert Storm. Post war analysis suggested there was little method to the Iraqis employment of mines.³⁰ Mines and anti-ship missiles extend the range of coastal defense. Though not a novel concept, the cost to employ them relative to the assets required to overcome them and the Nation's growing intolerance for casualties presents a nearly insurmountable obstacle. Though these threats are familiar in concept, the assets to counter them no longer exist.

The combination of fewer NGF ships and long range interdiction also levies a requirement to target much more accurately than in the past. During World War II vintage amphibious operations, the employment of NGF was often limited after the landing due to the inaccuracy of NGF. Targeting accuracy was a function of the spotter experience. Ship and airborne spotters accounted for targeting with the relative freedom to fire at just about anything. Unlike artillery, the flat trajectory of NGF limits the engagement of reverse slope or defilade targets.³¹ In addition, broad range dispersion tends to limit danger close targets unless there is a significant difference in elevation between the target and friendly forces, such as a cliff. Pre-landing fires historically had the luxury of firing up until the landing without the current constraints of collateral damage. After the landing, the presence of friendly forces and their progressive movement inland with the attendant fluctuations in terrain relief tended to prohibit further employment. On the other hand, interdiction along the coastal flanks or inland in

³⁰ Author noted during 1991 deployment to Gulf War with 5th MEB.

³¹ NGF trajectories are flat compared to mortars, but not necessarily artillery. At maximum range, the maximum ordinate of the existing 5" gun is approximately 30,000 feet.

moderately flat terrain within range and well beyond friendly forces fell into the pre-landing parameters where possible fratricide was not in contention.

Long range interdiction will perform a progressively greater role throughout subsequent conflicts. The potential casualties associated with a conventional amphibious assault can no longer be accommodated, particularly in the face of effective and inexpensive coastal defenses. OMFTS focuses on landing where the enemy does not expect it via deception and the increased landing area flexibility afforded by newer ship-to-objective assets like Landing Craft Air Cushion (LCAC), Advanced Amphibious Assault Vehicle (AAAV) and MV-22 Osprey (MV-22). With the advent of precision munitions, fixed positions, no matter how well fortified, can be reduced at great range or bypassed with little risk to landing forces. Amphibious operations are still a valid capability. Though an amphibious operation never materialized during Desert Storm, the Iraqis seemed convinced one was imminent and relied on extensive beach obstacles, mines, and pre-positioned counterattack forces similar to the strategy employed by the Axis forces in Europe during World War II. In the future, long range interdiction will follow a logical sequence of shaping the battlespace. Neutralization of fixed infrastructure, LOCs, and command and control (C2) are the initial focus of shaping prior to the insertion of ground forces. Once ground forces are ashore, some of those assets previously used for shaping are allocated to interdiction of mobile counterattack forces.

Quality Vs Quantity

There is a certain amount of reverent, if mostly psychological, awe associated with a vision of large gray ships bristling with guns firing repeated broadsides in support of an amphibious operation. Many historical accounts are rife with the exploits of NGF. As discussed previously, technical data tends to refute the effectiveness of NGF. On the other hand,

the qualitative effects of fear, shell shock and collateral damage caused by NGF are usually ignored in the development and acquisition process.

As circumstances were to bear out in many previous as well as following campaigns, the adversary was usually more than willing to dispute the landing. However, qualitative effects were telling. Consider General Saito's comments dispatched to higher headquarters towards the end of the Marianas Campaign voicing the frustration of continual bombardment from the sea that resulted in the nearly complete breakdown of his C2, which in turn prevented coordinated counter attacks.³² He said, "If there just were no naval gunfire, we could fight it out with the enemy in a decisive battle."³³

Capital Ship Mentality

Within the spectrum of power projection tools, NGF did not enjoy the attention typically associated with the more sensational and vogue tools like tactical aircraft, capital ships or cruise missiles. This may explain why naval guns never significantly changed after World War II. It may also explain some of the debate within the acquisition and requirements arena that occurred early on in the development of NSFS.

One could posit that the NGF capability developed during World War II occurred more as a result of circumstance than an actively pursued developmental process tailored exclusively for the support of amphibious assault. Some of this mentality lingers today and may in part explain the current lack of capability. Historical Navy pre-occupation with capital ships such as battleships and aircraft carriers, cruise missiles, and their associated hierarchical nuances may

³² Cowl, 62-64.

³³ Fleet Marine Force Reference Publication (FMFRP) 12-34-III, *History of the U.S. Marine Corps Operations in World War II: Central Pacific Drive, Vol. III*, Historical Branch, G-3 Division, Headquarters, U.S. Marine Corps, 1996. PCN 140 123403 00, 347.

help explain why the Navy has demonstrated a reluctance to avidly pursue or even maintain an enduring NGF capability following World War II.³⁴

During World War II, the aircraft carriers superseded the battleship as the Navy's capital ship. This indirectly contributed to NGF capability during World War II. The surprise attack on Pearl Harbor with the associated loss of so many battleships deserves some of the credit for pushing carriers to the fore. Additionally, airpower began to assert itself in an ever increasing role. New and faster carrier development proceeded commensurately with growing significance of airpower. Newer battleships were developed to keep up with the faster carriers. The remaining older battleships were soon bereft of a role because they lacked the speed to match that of the newer carriers. With this ironic twist of circumstance, and in recognition of the island hopping nature of the Pacific theater, the older battleships were available to support amphibious operations. Largely as a result of their initial effectiveness in providing NGF in concert with a growing fleet of newer ships, progressively more naval ships were allocated to the NGF role. The smaller strength of the British fleet tended to mitigate such pursuits in the European theater.³⁵

One conjecture posits that the Navy adheres to a service institutionalism deeply rooted in tradition that is in turn driven by the subtleties of a relatively unique operating environment - the sea and its inherent isolation, which is conducive to a rare sense of responsibility and self reliance. As Carl Builder suggests: "Independent command of ships at sea is a unique, godlike responsibility unlike that afforded the commanding officers in the other services. Until the advent of telecommunications, a ship *over- the- horizon* was a world unto itself, with its captain absolutely responsible for every soul and consequence that fell under his command."³⁶

³⁴ Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, (Baltimore, Maryland: The John Hopkins University Press, 1991), U.S. Marine Corps Command & Staff College Warfighting from the Sea Readings, Vol. I AY96-97, 253-264.

³⁵ Weller 47-54.

³⁶ Builder, 251.

He goes on to suggest that an enduring and natural byproduct of this independence is a focus or aspiration towards the pinnacle of naval service, command at sea, particularly command of what is recognized within the community as the biggest and most powerful ship. As mentioned previously, World War II marked the preeminence of the aircraft carrier which some would argue is still prevalent today. Analogous with the capital ship mentality is a hierarchical ranking of ships and, subsequently, the credibility associated with promotion eligibility. The classic example, though not as apparent today considering the recent emphasis on NSFS, is the esteem with which the amphibious fleet and even the amphibious mission is held - arguably at the bottom of the pile.³⁷

Summary: Are There Applicable Historical Parallels?

World War II coincides with a massive level of naval ship construction that fielded ships in such numbers that, unlike today, the lack of NGF was rarely a concern.³⁸ There are just over 80 - 5" gun capable ships in today's Navy. Of these, only the Spruance Class Destroyers, readily recognize the NGF mission.³⁹ History indicates the role of NGF, to include the degree with which it was employed, tends to coincide with the scope and nature of the conflict. The bigger naval guns disappeared with the gradual retirement of the World War II vintage ships. They became too costly to maintain or upgrade to a level compatible with today's much more technically sophisticated surface combatants.⁴⁰ In the proceeding interval, the technology

³⁷ Builder, 253.

³⁸ Cowl, 310.

³⁹ All ships equipped with 5" guns are required to go through NGF qualification. Unfortunately, the Navy is so over-committed that few get the chance to qualify.

⁴⁰ Department of the Navy, *Response to Questions from Mr Bill Fallon*. This is a formal Navy response to questions for the record from Mr. Fallon, Military Liaison Attaché for Representative Dornan (R-Ca) regarding the viability of returning battleships to active status. October, 1995. The information therein includes costs to reactivate battleships, provide crews, and update communication suites. It appears the

associated with the naval guns remained largely unchanged. The possible exception is the 5"/54 introduced during the Vietnam era.⁴¹ However, the 5"/54 is not a stand-alone NGF system in the parochial sense. It simply lacks the range and lethality to engage a broad variety of targets. Range makes it particularly unsuitable for long range interdiction.

Today's concern over the lack of NGF may reside in the continuing credibility of amphibious operations. During World War II, large numbers of NGF ships were used to support opposed amphibious assaults. After World War II, the scale and scope of conflicts did not require large scale amphibious assaults with the exception of Inchon. Instead, the nature of these conflicts promoted NGF interdiction. In the process, the sophistication of the coastal threat grew, driving NGF ships further out to sea. The amphibious assault is still a valid and prudent capability to maintain, but if recent conflicts are any indication, not on the scale of World War II. The same logic applied to NGF may explain the limited capability that exists today.

There are also important insights rooted in tradition to help explain some of the commonly misunderstood issues in the debate over requirements. Volume of fire was very instrumental in the support of amphibious operations during World War II, so much so, that it indelibly personified NGF capability for the next 40 years. As will be noted later on in this paper, the Marine Corps is very explicit and consistent in mandating that NSFS possess a "volume" capability.

Though the scope of subsequent conflict was clearly a factor in the decline of NGF, many outside the Navy mistakenly feel that the capital ship mentality drove decline. Today, NSFS is premised on precision guidance and accurate targeting to more efficiently engage targets without the volume. If there is any credibility to the capital ship mentality, perhaps the *novel* aspect of naval guns employing precision guided munitions will assist the development of

costs, \$150 to \$200 million per ship, and their impact on other competing budget priorities such as LPD-17, were convincing enough to allow the Navy to relegate battleships to an inactive reserve status.

⁴¹ Weller, 48-49.

NSFS.

CHAPTER 2

THE STRATEGIC SHIFT

NSFS is not NGF; rather, it is a multi-system approach combined with a new way of thinking representative of the ongoing Information Age.⁴² The Information Age heralds extremely rapid technological advance. This, in concert with the vagaries of the Post Cold War era, is driving new warfighting concepts. The threat will remain ambiguous though perhaps to a greater degree today in the absence of a peer competitor to provide an all-consuming impetus for defense investment characteristic of the Cold War. The political will to maintain a military force sufficient to handle every foreseeable contingency is questionable. As a consequence, the military services are pursuing more economical and intelligent approaches to warfare. Technology seems one way, however, it fosters an element of distrust. The development of NSFS is one capability among many in the naval service competing for scarce resources. Specifying a requirement and following through with an operative product in such a context is a difficult enterprise.

The Driving Variables

The development of NSFS is influenced by three major variables. They are: (1) the difficulty in identifying future threats with the absence of a superpower threat like the former

⁴² Earl H. Tilford, Jr., *The Revolution in Military Affairs: Prospects and Cautions*, (Carlisle, PA: U.S. Army War College, Strategic Studies Institute, 1995), U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings (AY 96-97), Vol. III, 245-246.

Soviet Union, (2) the resultant impact this has on downsizing the defense budget, and (3) a growing emphasis on new technology to compensate for the impact of defense downsizing.

The Absence of a Superpower Threat

*“When the war of giants is over, the wars of the pygmies will begin.” Winston Churchill*⁴³

With the end of the Cold War, military planners realized that the absence of a superpower threat like the former Soviet Union does not necessarily connote a peaceful global climate. On the contrary, an all-encompassing, known threat has been replaced by a variety of smaller and diverse non-specific threats. These threats are generally smaller in scale and lean towards the unconventional operational spectrum. If not confronted in their infant stages, they possess the potential to evolve into global conflagrations. Consequently, a prudent threat assessment must encompass a multiplicity of potential threats running the gamut from conventional war to Military Operations other than War (MOOTW) ⁴⁴

Despite military experience gained in the last few years and a steadily declining defense budget, policy makers continue to embrace a two major regional conflict (MRC) force structure mandated in the last Bottom-Up Review (BUR). This is largely because the ability to foresee future threats to national security is, at best, speculative. This allows for a certain amount of latitude in the debate over how much force level is required. However, the current force level is roughly three-quarters the size of the Cold War force at half the funding.⁴⁵ Whether the two

⁴³ James B. Simpson, *Simpson's Contemporary Quotations*, (Licensed from Houghton Mifflin Co. Electronic version licensed from portions of 1994 InfoSoft Int'l, Inc., 1988).

⁴⁴ U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century*, (Fort Monroe, VA: U.S. Army TRADOC, 1 August 1994), U.S. Marine Corps Command & Staff College Warfightingfrom the Sea Readings (AY 96-97), Vol. I, 9-10.

⁴⁵ Elliot A. Cohen, *Beyond Bottom Up*, Strategic Level of War Required Readings, Vol. II, AY 1996-97, 126.

MRC force structure possesses sufficient capability to address the nontraditional character of MOOTW in concert with near simultaneous MRCs is readily becoming moot. It can, at least in the near term. The more relevant issue is whether the military will possess sufficient capability in the future in light of the impact current domestic budgetary trends will have on defense spending.⁴⁶

Domestic Politics and Their Impact on Defense

A related consequence is the steadily shrinking defense budget and the subsequent impact on military force structure. The American public expects increased attention on domestic concerns and views the Defense Department as a lucrative financial resource.⁴⁷ The military, striving to maintain viability in the face of defense cuts, perceives an opportunity to not only maintain, but improve combat effectiveness via more efficient operational procedures or concepts. These concepts, in conjunction with advanced technology,⁴⁸ accommodate downsizing while still providing the capability to defeat future adversaries.⁴⁹

Technically, war is one of the tools the state uses to achieve its political aims. During war, the ongoing relationship between policy makers, military leaders, and the nation at large have a direct bearing on the outcome of the war. The same relationships are applicable to MOOTW. Today, with near instantaneous media coverage, political aims must enjoy the

⁴⁶ Mackubin T. Owens, *Strategy Resources: Trends in the U.S. Defense Budget*, ed. Williamson Murray, 1995-1996 *Brassey's Merston American Defense Annual: The United States and the Emerging Strategic Environment*, (United States of America: Ohio State University Press, 1995), 162-165.

⁴⁷ Owens, 162-165.

⁴⁸ U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5. *Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century*. Fort Monroe, VA: U.S. Army TRADOC, 1 August 1994. Preface.

⁴⁹ Martin van Creveld, *Technology and War; From 2000 BC to the Present*, (New York: The Free Press, 1989), 319.

support of the nation to justify the possible commitment of military forces. It follows that political aims determine national policy. In turn, strategy is derived from policy and subsequently determines the military objective and its extent. Between the military and politicians, this relationship is a mutual recognition of responsibilities and flexibility in adjusting to changes in policy and their translation into strategy. However, the most influential, and therefore crucial, relationship is that between the politicians and the people. This defines the degree and sustainability to which national policy is compatible with the national will.⁵⁰

The BUR force level faces anywhere from \$40 to \$150 billion funding shortfall over the next five years depending on the queried agency.⁵¹ This is a consequence of maintaining current force levels and operations tempo or readiness at the expense of modernization and research and development of new technologies to maintain our military edge in the future. To a certain degree, readiness is ameliorated by the residual strength left over from the Cold War build up.⁵² However, near term readiness has resulted in the growing modernization debt which includes the procurement of new equipment to replace old. New equipment procurement is a lengthy process and has to occur several years before the existing equipment reaches the end of its service life to preclude future gaps in capability. The longer modernization is forestalled, the greater the risk of significant gaps in future capability.⁵³ Compared to the more exotic weapon systems such as the Sea Wolf submarine or a new aircraft carrier, improving NSFS seems trivial by comparison.

⁵⁰ Franz Uhle-Wettler, “**War**,” in ed., Franklin D. Margiotta, Brassey’s *Encyclopedia of Military History and Biography*, (Washington, D.C.: Brassey’s, 1994), U.S. Marine Corps Command & Staff College, Theory and Nature Of War Readings, Vol. I, 71-75.

⁵¹ Owens, 167.

⁵² Andrew F. Krepinevich, *The Clinton Defense Strategy*, ed. Williamson Murray, 1995-1996 *Brassey’s Merston American Defense Annual: The United States and the Emerging Strategic Environment*, (United States of America: Ohio State University Press, 1995), 131.

⁵³ Owens, 162-182.

Post Cold War defense cut backs may seem premature in light of recent operational tempo,⁵⁴ however increased defense spending is flatly not an option. The FY96 Presidential Budget forecasted a further 7% cut in defense spending out to the year 2002.⁵⁵ Unless there are drastic changes in overall spending policy, the budget deficit is expected to grow from \$397 billion in 1999 to 1.5 trillion in 2020.⁵⁶ The expected growth in deficit is predominantly attributable to non-discretionary funding or “entitlements” that currently represent roughly 50 percent of the overall budget. Entitlements, primarily health care and pensions, are not currently subject to any constraint other than eligibility. At the current growth rate, entitlements will exceed two thirds of the overall budget by 2000.⁵⁷ This is the same time frame the Navy plans to begin fielding improved 5” guns and perhaps prototype a land attack missile system.⁵⁸ The remainder or discretionary portion of the budget includes defense and domestic spending. Considering the emphasis on domestic issues, deficit reduction, and tax cuts, defense, practically by default, is relegated to the role of catch-all government slush fund.⁵⁹ Whether the inevitability of further cuts in defense is prudent for national security may have little bearing on the ideology that demands the cuts.

⁵⁴ John R. Galvin and Jeffery S. Lantis, *Peacekeeping and Power Projection? Conventional Forces for the Twenty-first Century*, ed. Williamson Murray, 1995-1996 Brassey's Mershon American Defense Annual: The United States and the Emerging Strategic Environment, (United States of America: Ohio State University Press, 1995), 184-185.

⁵⁵ Author not specified, *Strategic Assessment 1996: Elements of U. S. Power*. U.S. Marine Corps Command & Staff College Strategic Level of War Required Readings, Vol II, AY 1996-97, 21.

⁵⁶ Owens, 162.

⁵⁷ Owens, 163.

⁵⁸ Naval Sea Systems Command (NAVSEA) Program Manager (PMS 429), *Naval Surface Fire Support: Program Overview*, Brief to LtGen Paul K. Van Riper, Commanding General, Marine Corps Combat Development Command and MGen Hanlon, Director, Expeditionary Warfare Division (N85), OPNAV. No date specified.

⁵⁹ Owens, 165.

New Technology

*Long range precision capability, combined with a wide range of delivery systems, is emerging as a key factor in future warfare. ...The combination of these technology trends will provide an order of magnitude improvement in lethality. Commanders will be able to attack targets successfully with fewer platforms and less ordnance while achieving objectives more rapidly and with reduced risk.*⁶⁰

The advent of tank and airplane are a couple of examples of technology that took more than a decade to comprehend their potential strengths and effective means of employment. Will NSFS undergo a similar process? There is a growing emphasis on precision guided munitions (PGMs) to compensate for the impact of defense downsizing. The use of PGMs for NSFS promises to alleviate logistically burdensome land-based stockpiles of ammunition vis-à-vis greater range and accuracy. On the other hand, cheaper low to mid altitude air defense systems bode ill for the ability of close air support (CAS) to serve as a potential gap filler.⁶¹

The move towards the potential force multipliers inherent in advanced technology across the warfare spectrum, particularly information systems,⁶² is equated to a Revolution in Military Affairs (RMA).⁶³ Conceptually, RMAs are not novel circumstances. However, there are two

⁶⁰ J.M. Shalikashvili, General, USA, Chairman of the Joint Chiefs of Staff. ***Joint Vision 2010: Force of the Future*** July 1996, U.S. Marine Corps Command & Staff College Warfighting from the Sea Readings, Vol. II, AY96-97, 387.

⁶¹ Naval Studies Board National Research Council. ***The Navy and Marine Corps in Regional Conflict in the 21st Century***, June 1995, 56-59.

⁶² TRADOC Pamphlet 525-5, ***Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century*** (Fort Monroe, VA: U.S. Army TRADOC, 1 August 1994), Preface.

⁶³ Earl H. Tilford, Jr. ***The Revolution in Military Affairs: Prospects and Caution***. Carlisle, PA: U.S. Army War College, Strategic Studies Institute, 1995. U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings, Vol. III. 245.

important considerations. If history is any indication, RMAs sometimes take decades to mature into working concepts and they encompass more than technological advance. RMAs are “a major change in the nature of warfare brought about by the innovative application of technologies which, combined with dramatic changes in military doctrine, and operational concepts, fundamentally alters the character and conduct of operations.”⁶⁴

The transition from traditional NGF, typically viewed as an individual weapon system capability like artillery or close air support, to NSFS can be viewed in a similar context. Consequently, the full exploitation of NSFS could take perhaps 50-60 years. Richard Simpkin ⁶⁵ suggests that nearly every time there is a radical change in military innovation, whether with regards to equipment, doctrine or force structure, 30 to 50 years pass before operational use is perfected. Moreover, eventual operational use only vaguely resembles the original intent for which the innovation was designed. This may in part explain some of the frustration encountered by the Marine Corps at the seeming snail-like pace of ongoing NSFS improvements.

The advent of the tank is attributed to a desire to break the “deadlock”⁶⁶ of World War I trench or attrition warfare. While the tank was introduced in World War I, it took another 30 years before the interaction of military strategists and the demands of war melded these technologies into useful military application. Moreover, it was usually those states that were first to combine technology with appropriate unit organization and doctrine who achieved a significant, though often temporary, margin of tactical success. J.F.C. Fuller and Liddell Hart, among others, wrote extensively on the potential of armored warfare and its novel application to maneuver. However, their respective countries never exploited the tank until the Germans

⁶⁴ Tilford, 246.

⁶⁵ Simpkin, 41.

⁶⁶ R.L. DiNardo, *German Armor Doctrine: Correcting the Myths*, U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings (AY 96-97), Vol. III, 276.

demonstrated its potential in World War II.⁶⁷ However, this potential evolved into more than just the unique capabilities of the tank. World War II Germany is credited with concept of combined arms or “Blitzkrieg”⁶⁸ which was used to defeat both the French and English, qualitatively comparable forces, and the Russians, a numerically superior force. Success was attributed to “the innovative operational exploitation of systems common to both sides: the tank, airplane, and radio. Speed surprise, and deception, combined with superior tactical and operational performance, gave the Germans a degree of relative operational superiority to which the allies failed to adapt in time.”⁶⁹

Summary: What is Influencing the Development of NSFS?

The apparent absence of threats, domestic politics, and new technology have all influenced the direction of NSFS. The first two are not historical anomalies, but with new technology there is a combined effect that appears ambiguous. This promoted hesitancy in accepting the NSFS concept. NGF may no longer be adequate to confront future threats, but its past exploits are well known and provide a degree of comfort that is difficult to resist in the face of the less familiar alternative of NSFS. Specific threat based doctrine is difficult to develop. Correspondingly, there is little to incorporate into concept development. In the interim, new technology is dramatically cutting down the time between the development of the NSFS concept and operational capability. This leaves little time for concept refinement. The full utility of the

⁶⁷ John Cranston, *J.F.C. Fuller and Liddel Hart: Contrasting Theories of Armor Development*, U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings (AY 96-97), Vol. III, 269-270.

⁶⁸ James R. Fitzsimons and James M. Van Toll, *Revolution in Military Affairs*, *Joint Forces Quarterly*, (Spring 1994), U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings (AY 96-97), Vol. V, 240.

⁶⁹ Fitzsimons and Van Toll, 240.

tank was not understood and applied until almost a quarter of a century after its appearance on the field of battle. NSFS, as a stand-alone concept, does not qualify as an RMA. However, it is subject to the steam rolling influence of the Information Age RMA.

CHAPTER 3

THE GENESIS OF NAVAL SURFACE FIRE SUPPORT

“Operational Maneuver from the Sea is the application of the principals of maneuver warfare to a maritime campaign²². Operations are designed to break the cohesion and integration of enemy defenses while avoiding attrition style, head-on attacks.”⁷⁰ Further, “successful execution of OMFTS will drive changes in fire support, 2forces afloat and ashore require the ability to deliver fires with increased range and improved accuracy and lethality.”⁷¹ The Navy and Marine Corps conceptual response to the strategic shift resides in three documents: (1) From the Sea,⁷² (2) Forward From the Sea,⁷³ and (3) OMFTS. All three documents are complimentary and reflect a strategic shift in focus from predominantly "blue water" operations and conventional amphibious assault to seamless maritime power projection ashore in the littorals.⁷⁴ The first two address the operational to strategic levels of war. OMFTS focuses on the operational level and is, therefore, the most appropriate document to use in addressing NSFS. The OMFTS concept combines expanded battlespace, enhanced mobility, maneuver, battlefield awareness, and firepower to improve the combat effectiveness of naval forces.

⁷⁰ Chief of Naval Operations, Director, Surface Warfare (N86) and Office of the Assistant Secretary of the Navy (Research, Development and Acquisition), ***Report on the NSFS Program Plan***, a report directed by directed by the FY1995 Defense Authorization Conference Committee Report 103-701. April 1995. Hereafter referred to as “***SECNAV Report on the NSFS Program Plan***, April 1995.

⁷¹ C.C. Krulak, General, USMC, Commandant of the Marine Corps, ***OMFTS***, Headquarters, Marine Corps, Washington DC, Summer 1996, 17.

⁷² DoN, ***FFTS***, Washington DC, Introduction.

⁷³ DoN, ***FFTS***, Washington DC.

⁷⁴ DoN Naval Doctrine Publication 1, ***Naval Warfare***, Washington DC, 28 March 1994, 59-60.

Enter OMFTS

In light of the dynamics of the post Cold War era, the future vision of naval warfighting emphasizes a shift in the operational employment of expeditionary forces to the littorals where the major population centers are located.⁷⁵ OMFTS implies more than traditional amphibious operations at longer ranges. It also includes the seaward extension of the maneuver warfare principles of tactical mobility, operational speed, and flexibility. The goals are first to create confusion in the enemy's defense and then to exploit it. The primary objective is to defeat rather than destroy the enemy. OMFTS is premised on over-the-horizon (OTH) operations.⁷⁶ OTH operations are predicated on two features: operational surprise, and evading the growing anti-ship cruise missile and mine threat.⁷⁷ This requires an initial standoff distance of 25 NM.⁷⁸

Ship-To-Objective Maneuver

Conventional amphibious assaults are executed in four phases: (1) maneuver in ships, (2) ship-to-shore movement, (3) lodgment establishment to build combat power, and (4) maneuver

⁷⁵ P. K. Van Riper, Lieutenant General, USMC, Commanding General, MCCDC. **OMFTS**. Quantico, Virginia, 28 August 1996, A-1. The Commandant of the Marine Corps (CMC) signed out OMFTS on 4 January 1996. This copy was provided to students at the Command & Staff College by CG MCCDC.

⁷⁶ **1992 Mission Need Statement (MNS) NSFS**. The NSFS MNS was approved while OMFTS was in its formulate stages. OTH standoff range was specified at 25 NM. It seems apparent at the time that the term "OTH operations" was merely precursor terminology that formed the basis for the eventual promulgation of the Marine Corps' OMFTS white paper in August of 96.

⁷⁷ **1995 SECNAV on the NSFS Program Plan**, April 1995, 7.

⁷⁸ MCCDC, Requirements Division, **Near-term USMC NSFS Requirement**, 3 November 94. Via direction of the CNO, MCCDC re-examined the range requirement for NSFS and generated this document. It stated that a minimum range of 41 NM was required to provide direct support for landing forces and an objective range of 63 NNM was required to provide direct support and counter battery fires in support of assault forces. 41 NM was based on a 25 NM standoff plus 16 NM for the maximum range of 155 mm artillery. The CNO subsequently approved this requirement in December 1994.

to objectives. Ship-to-objective maneuver (STOM)⁷⁹ proposes to eliminate phasing. Combined with new high mobility amphibious assets like the MV-22 Osprey (MV-22) and the Advanced Amphibious Assault Vehicle (AAAV), STOM will allow the landing force to maneuver toward inland objectives directly from naval shipping positioned over-the-horizon.⁸⁰ Greater mobility will provide the ability to conduct amphibious operations almost anywhere along the coastline and project power farther inland. This forces potential adversaries to defend vaster areas and, in the process, dilute the concentration of their forces.

What Does OMFTS Imply for NSFS?

The chief characteristic of OMFTS, a much broader depth of coverage, presents a rippling series of requirements.⁸¹ The challenge lies in the expanded battlespace implicit in OMFTS which suggests maneuver elements will operate over a much wider spectrum of ranges, not only in terms of initial standoff distances on the order of 25 miles, but also in terms of penetrating inland to take advantage of future mobility enhancements. “The LCAC and planned introduction of the AAAV and MV-22 rotary winged aircraft form the mobility triad that permits seamless transition from maneuvering at-sea to maneuvering ashore, thereby making the over-the-horizon assault and ship-to-objective maneuver possible.”⁸²

⁷⁹ U.S. Marine Corps, *A Concept for Ship-to-Objective Maneuver* (STOM). Draft Marine Corps concept paper, Mar 1996, U.S. Marine Corps Command & Staff College Warfighting from the Sea Readings, Vol. II, AY96-97. 111-115. Here after referred to as “STOM.” February 1996.

⁸⁰ U.S. Marine Corps, *A Concept for STOM*, 111-115.

⁸¹ *OMFTS*, A-5, 6.

⁸² *SECNAV Report on the NSFS Program Plan*, April 1995, 15.

With the advent of the MV-22, distances on the order of 200 miles, predominantly over land, are possible. Therefore, regardless of whether NSFS assets move closer to shore to extend inland range once surprise is no longer paramount, the distance issue remains constant. In addition, these distances generate much longer response times in terms of time of flight and potential delays associated with the connectivity between target acquisition sensors and the sea-based weapon system.

OMFTS will require much longer range fires to cover the expanded battlespace. As conceptualized, a sizable portion of fires will be sea based and positioned, at least initially, up to 25NM or more offshore. In addition, maneuver units will operate further inland and operate over a much larger area. Forces will also maneuver with a greater degree of independence, possibly without contiguous LOCs in turn limiting the amount of organic fire support they can carry with them. In addition, the expanded battlespace will still require some degree of isolation or interdiction to allow maneuver forces freedom to accomplish their mission.⁸³

In addition, OMFTS strongly suggests sea-basing the preponderance of fire support and its associated logistics so as to minimize footprint ashore. Unhampered by long and ponderous logistics tails, subsequently leaner maneuver forces can capitalize on their inherent mobility and maneuverability coupled with the greater availability of lift assets to focus exclusively on battlefield objectives. However, the tradeoff resident in the absence of lodgments and land LOCs tends to preclude the opportunity to establish and sustain the quantity of land-based fire support maneuver forces are accustomed to and subsequently levies an additional burden on sea-based NSFS to compensate.

Moreover, in lower intensity OMFTS operations, NSFS may not only substitute artillery during the initial stages of STOM, but may also replace artillery during the remaining land portion of STOM. Why? OMFTS, though it may initiate sustained operations ashore, does not

⁸³ *OMFTS*, A-5, 6.

necessarily include sustained operations where mandatory shore based logistics makes artillery a more likely participant. Instead, maneuver forces will rely on surprise, speed, and superior battlefield awareness to pounce on, secure objectives from over-the-horizon (OTH), and retire before the enemy has a chance to react.

And, finally, there has been and continues to be significant congressional interest in NSFS emphasizing the importance of a credible power projection/forcible entry capability and the associated improvement of NSFS at the same pace of other related programs like MV-22 and AAV that are designed to support and improve OMFTS operations. NSFS must support OMFTS operations throughout, seamlessly and without gaps⁸⁴ with: (1) deep fires to support pre-assault/battlefield preparation or shaping, (2) long range fires in close support of forces during the land portion of STOM, (3) sustainable fires to support extended operations ashore, and (4) interdiction and counterfires throughout to isolate objectives.⁸⁵ This implies the need for a *variety* of different sea-based systems to include tactical aviation, and both surface and subsurface launched missiles.⁸⁶

The NSFS Vision

The concept of NSFS includes the coordinated and complimentary use of naval weapon systems and implies a combination of systems including guns, missiles, rockets, targeting, and communications, to provide fire support for expeditionary operations.⁸⁷ NSFS substitutes for

⁸⁴ John Hopkins University, Applied Physics Laboratory (JHU/APL), *NSFS Road Map Study*, brief presented to OPNAV N864 (formerly N863), 1 April 1996.

⁸⁵ JHU/APL, *NSFS Road Map Study*, brief presented to OPNAV N864, 1 April 1996.

⁸⁶ CNA. *NSFS COEA Final Report*. October 1994. CNR 210.

⁸⁷ OPNAV N86, *NSFS Brief to the CNO Executive Board (CEB)*, 14 December, 1994. Major General Mike Myatt, then Director, Expeditionary Warfare Division, N85, presented “requirements” portion of brief. The Director, Surface Warfare Division, N86, briefed the technical, programmatic, and funding portions. This served to indicate the continuity between Marine Corps requirements and Navy weapons system development. Here after referred to as “CEB, 14 Dec 1994.”

landing force artillery until it is operational ashore then NSFS supplements organic artillery. As a combination of systems, NSFS should capitalize on naval aviation but not replace it.⁸⁸ Additionally, NSFS is more than ships' guns, missiles, and tactical aviation. It is an architecture that allows the integration and employment of these and other systems as the situation may direct to provide a synergistic effect to defeat an enemy.⁸⁹ The shrinking defense budget also dictates the integration of suitable existing systems.

NSFS bears little resemblance to NGF, however it is frequently perceived by some as nothing more than naval guns. The novelty of 5" gun improvements tends to confine the definition of NSFS to naval guns because the other complimentary systems largely exist. In addition, the linkage to rapidly coordinate the capabilities of a variety of systems is still under development.⁹⁰ Concept and capability are frequently used interchangeably and tend to aggravate efforts to solicit support within the acquisition arena, particularly during the competitive Projected Objective Memorandum (POM) cycle. In reality, there is very little in common, yet the crux of the debate revolves around the perception that the two terms are, with the exception of advances in technology, synonymous. NGF advocates tend to be those with combat experience and are hard to refute when it comes to developing requirements acceptable to all concerned. Their opponents stress that the need to start a program clearly surpasses no capability at all. Nonetheless, debate is constructive in that it helps to ensure a well thought out program.⁹¹

⁸⁸ *CEB*, 14 Dec 1994.

⁸⁹ *CEB*, 14 Dec 1994.

⁹⁰ *NSFS Program Plan Brief*, August 96.

⁹¹ Author served a three year tour with OPNAV N85 working NSFS issues during the period in question. In reality, available and likely available resources as opposed to the actual need, drive the requirements process.

Existing Capability

Until NSFS is a fully operational capability, there will continue to be greater reliance on naval aviation to perform the OMFTS fire support role. There are just over one hundred 5” guns⁹² mounted on Navy cruisers and destroyers.⁹³ They are largely ineffective in of themselves, particularly with regards to range, accuracy, and lethality. In addition, today’s ships are multi-mission capable which tends to limit them for dedicated fire support. As a result, any near term OMFTS operation will rely to a much greater degree on tactical aviation, and, potentially though limited, use of sea-based land attack missiles like the TOMAHAWK Land Attack Missile (TLAM) for the preponderance of fire support. Once the maneuver elements are ashore, artillery and attack helicopters may compliment these capabilities depending on whether the scope of operation permits the required logistics footprint.⁹⁴

Greater reliance on tactical aviation and TLAM assets, assuming competing missions permit a significantly expanded NSFS role, is not the necessarily the optimal mix to afford the flexibility essential in OMFTS. Responsiveness and flexibility are also significantly reduced because of greater lead time required for planning and coordination.⁹⁵ Tactical aviation sortie

⁹² Donald M. Weller, MGEN USMC (Ret.). *Naval Gunfire Support of Amphibious Operations: Past, Present and Future*. (Arlington , VA: Universal Systems, Inc.) A Study prepared for Naval Sea Systems Command (NAVSEA) and Headquarters U. S. Marine Corps. October, 1977, 9, 48.

⁹³ *SECNAV Report to Congress on NSFS*, July 92. The SECNAV report actually says “over 150 guns.” At the time however, the Navy was embarked on an ambitious effort to scrounge money to support the budding NSFS Program. Since the 5” guns on LHA class amphibious ships were rarely used in practice or even regularly qualified for that matter because it interfered with flight and well deck operations, OPNAV wanted to use them to help mitigate a \$202M programming shortfall. Hereafter referred to as “SECNAV Report to Congress, July 92.

⁹⁴ IDA, 23.

⁹⁵ CNA, *Memorandum for MGEN H. W. Jenkins (N85) and Mr. Ronald Kiss (DASN (Ships)), Co-Chairs, NSFS COEA*, Subject: NSFS COEA, 14 January 1994, 05 94-0111. This memorandum includes two enclosures; one that summarizes the COEA in general, and one that addresses the extent of the role tactical aviation played in the COEA. The COEA also includes the complimentary role of tactical aviation.

time is lengthy unless planes are on station and then time on station limits availability to windows. Tactical aviation is increasingly vulnerable to a growing variety of sophisticated threats and are limited by weather.⁹⁶ TLAM is very costly,⁹⁷ slow, and typically subject to stringent release control requirements. Both tactical aviation and TLAM are subject to competing mission priorities.⁹⁸

The existing 5” gun, is limited in range, accuracy, and lethality. Initial standoff distance precludes the 5” gun from participating at the outset of an OMFTS operation. It does not possess the lethality to engage other than soft targets. It is also inherently inaccurate. This lack of lethality causes the expenditure of large quantities of ammunition to achieve desirable effects.⁹⁹ As a result, today’s existing NSFS cannot adequately support OMFTS.

As early as 1992, planners seemed to have already been leaning towards an improved NSFS capability. The 1992 NSFS Mission Need Statement (MNS) articulated the following deficiencies:¹⁰⁰ **“The existing capability cannot provide the range or lethality to influence the threat to inland HLZs or interdict follow-on forces. 2the flat trajectory results in significant range dispersion and difficulty in engaging targets in defilade. Also, long range saturation is required in high intensity conflict. Existing systems are not configured to use**

⁹⁶ CNA, *Memorandum for MGEN H. W. Jenkins (N85) and Mr. Ronald Kiss (DASN (Ships)), Co-Chairs, NSFS COEA*, Subject: NSFS COEA, 14 January 1994.

⁹⁷ LCDR Bernie Carter, OPNAV N864G, Interview conducted November 1996. TLAM averages between \$1 to \$1.3 million per copy depending on variant.

⁹⁸ IDA, 25.

⁹⁹ CNA. *NSFS COEA Final Report*. October 1994. CNR 210. 3-4.

¹⁰⁰ *1992 MNS for NSFS*. Previous analyses, one in particular conducted in 1977 by MGEN Weller, USMC (Ret), working at the time for a local defense contractor, developed an NGF study to analyze the future the requirement for naval gunnery. The premise concerned the apparent “loss of corporate memory on the use and effectiveness of naval gunnery.” The section addressing future requirements very accurately predicted the need for greater range (15 NM) and lethality. He also comments that the 5”/54 is inadequate to serve the target sets characteristic of World War II, Korea, and Vietnam.

developing technology for battlefield surveillance, communications, fire adjustment and position location. The deficiency exists now,²¹⁰¹

Requirements

Per the 1992 Mission Need Statement (MNS),¹⁰² NSFS should: (1) “provide for an NSFS system comprised of ship mounted guns, rockets, and/or missiles that provide preparation and supporting fires to an assault force landing on defended territory,” (2) “provide NSFS in Over-the-Horizon context, with a wide range of capabilities to support all phases of an amphibious assault with the ability to engage fixed and mobile targets, both hard and soft,” (3) “provide accurate area saturation and neutralization fires,” (4) “counter the enemy artillery threat to inland helicopter landing zones (HLZs),” and (5) “interdiction.”¹⁰³ Regardless, the key results of several NSFS studies were considered in the current NSFS plan to include the 1992 NSFS Report to Congress, the 1993 IDA study, and the 1994 NSFS COEA. These analyses shared two conclusions:

A combination of systems is required because no one system can best fulfill all the requirements that encompass a broad spectrum of ranges. This spectrum covers the following: (1) very short ranges from two to five NM, (2) initial OMFTS standoff ranges from 20 to 60 NM, and (3) long ranges out to 200 NM to support mobility enhancements such as the MV-22. Threats, and operating environments are equally broad. Therefore, it is not operationally sound or cost effective to depend on one system. Affordability resides in configuring the most cost and operationally effective mix of existing systems designed specifically for NSFS, existing systems not otherwise designed for NSFS but never-the-less adaptable, and new systems. Of candidate

¹⁰¹ **1992 MNS for NSFS.**

¹⁰² **1992 MNS for NSFS.**

¹⁰³ **1992 MNS for NSFS.**

weapon system concepts studied, large caliber, 6” and up, naval guns were determined to be the most cost effective.¹⁰⁴

Precision guidance is required to maintain accuracy over the nominally greater ranges implied in OMFTS. Ship motion increases errors for naval guns to about twice that of land-based artillery, and 5”/54 accuracy degrades dramatically beyond 13 NM.¹⁰⁵

In December 1994, the CNO, in consonance with the MNS, approved a near term program plan to provide NSFS in support of ground forces to an objective range of 63 NM. He also directed the development of a long term plan to address mid-term and future requirements. Other salient points included:¹⁰⁶

Proceed with range and accuracy improvements to existing 5” guns, to include developing a precision guided projectile to provide a near-term improvement in NSFS capability by 2001.

This refers to requirement developed by the Marine Corps Combat Development Command (MCCDC)¹⁰⁷ that stipulated a threshold range of 41.3 NM and objective range 63.1 NM.¹⁰⁸

Appendix B describes these improvements.

¹⁰⁴ CNA, *NSFS COEA Final Report*, CNR 210, October 1994, 3. The 1994 NSFS COEA offers the most up to date cost comparison of various caliber guns and missiles. The COEA also compared tactical aviation and new 155mm naval guns and concluded that they were both roughly on par financially. Though tactical aviation is inherently more expensive to use, the cost to develop new guns balanced the difference. Operational considerations (sortie generation, weather, captured pilots, etc.) and unique capabilities provided a clearer means of comparison in specific scenarios. (authors opinion) The bottomline is that tactical aviation and naval guns are highly complimentary.

¹⁰⁵ **3 October 1994 CEB.**

¹⁰⁶ Chief of Naval Operations (N86) letter to Commander, NAVSEA, 3330 Ser N863F/ 5U657542, subject: *NSFS Program Guidance*, 18 January 1995. This letter references the 14 December 1994 CEB which compiled the action items recorded during the actual brief.

¹⁰⁷ In response to the 3 October 1994, the MCCDC revalidated the range requirement for NSFS. from the perspective of OMFTS and current threat artillery capabilities. NSFS should be able to fulfill the requirement for artillery indirect fire during the critical initial phases of ship-to-objective maneuver and then supplement organic artillery once it is ashore. Therefore, NSFS capabilities should at a minimum, match organic artillery capabilities in terms of range accuracy and lethality.

¹⁰⁸ The DoD 5000 series defines “threshold” and “objective” as performance parameters. “Threshold” identifies the minimum acceptable range to satisfy the mission need. “Objective” represents a measurable and beneficial increase in capability above threshold. According to the 3 November 1994 MCCDC NSFS

Leverage existing and parallel technologies to develop the necessary C4I to integrate the improved NSFS system and the means to employ it.

Proceed with shipboard test launches of ATACMS, Sea Slam, and Standard Missile demonstrations to evaluate the potential of missiles in NSFS roles.

Develop a combined Navy and Marine Corps campaign plan¹⁰⁹ that provides a basis for mid-term and future requirements and serves as a long term master acquisition plan to meet these requirements.

To the general observer, it would seem that the plan as outlined by the CNO is pretty thorough. It is also important to emphasize that the CNO stressed brevity in fielding a near term improvement, however lacking it potentially was, in addressing the likely spectrum of NSFS requirements. The near term improvement would represent the first part of an incremental approach to providing a full capability, budget allowing, sometime in the not too distant future.¹¹⁰

Subsequent formal analyses and studies conducted by prominent government laboratories broadly categorized deficiencies within the context of range, lethality, and accuracy or very

Requirements position paper (see Bibliography) and as implied in OMFTS, NSFS must be nominally capable of supporting operations from at least 25 NM off shore during the initial phases of the operation. Existing artillery range plus standoff (16.8 NM + 25 NM) equates to the threshold range for NSFS of 41.3 NM. 63.1 NM represents the objective range in consideration of counterbattery fires against threat artillery. NSFS should also provide the capability to conduct counter-battery fire against enemy systems able to attack friendly units operating within the threshold range, particularly protecting landing force elements arriving by helicopter from direct fire and indirect fire. The accepted range for threat tube artillery determined by the Army Field Artillery System COEA is 21.8 NM. Accordingly, the NSFS objective range is 63.1 NM (41.3 NM threshold + 21.8 NM).

¹⁰⁹ JHU/APL was tasked with this particular action item. Initially, there was quite a bit of debate over assigning the development of military requirements to a government laboratory as opposed to war fighters.

¹¹⁰ *SECNAV Report on the NSFS Program Plan*, April 1995.

similar parameters.¹¹¹ These parameters are largely applicable to the weapon with less regard for the complete system, in this case, the means to target and communicate targeting data to these weapon systems.¹¹² **There is a trend here and it is chronic to the NSFS concept.** It concerns the seeming pre-occupation with the “weapon” without regard for the means to employ it. Previous NSFS related studies, though careful to mention the criticality of targeting and C2, rarely address these aspects to extent they do weapon system characteristics. Readers typically come away with a clear understanding of desirable weapon characteristics.

From the Marine Corps perspective, there were initially two aspects of weapon system characteristics that are deemed crucial to NSFS in support of OMFTS. These are responsiveness and volume of fire. Specifically, the Marine Corps advocated responsiveness and volume of fire on par with artillery.¹¹³ Volume of fire falls under the broader category of lethality and is by far the most difficult to address, let alone quantify. Later, the Marine Corps updated the

¹¹¹ Nearly every reference regarding NSFS requirements starts out with the words deficient, limited, non-existent, etc.,... Range and accuracy are linear aspects, and therefore relatively easy to comprehend and subsequently “sell”. Range is emphasized the most largely because it is easiest aspect to comprehend or visualize and therefore caters to the broadest audience. Accuracy is similarly viewed as a desirable characteristic though it is often confused with precision or the tightness of the group irrespective of target location accuracy. Few consider the second vital component of accuracy, namely how well located the target is.

¹¹² Detailed studies are careful to articulate targeting and C4I connectivity as intrinsic to the NSFS equation. Rarely, however, do targeting and C4I enjoy the emphasis weapon systems do particularly in acquisition documentation. Accordingly, the weapons are funded while targeting and C4I means are for the most part neglected. Nor do C4I and targeting enjoy the sensationalism characteristic of a weapon. In addition, the recent emphasis on joint interoperability and connectivity strongly suggest that there are other systems to leverage, so why spend limited funding on something another department is already doing if there exists the prospect that this system may be leveraged for NSFS at substantial cost savings. The difficulty lies in communicating and establishing a mutually acceptable leveraging agreement that will actually result in a functioning capability.

¹¹³ Commanding General, MCCDC, Position paper developed to articulate the Marine Corps’ near term NSFS requirement, C445. Subject: ***The Marine Corps Requirement for Naval Surface Fire Support (NSFS)***, 3 November 1994. The 63 NM requirement was soon coined the “near term” requirement as the greater implications of OMFTS gleaned chiefly through war games identified the potential limitations of the improved 5” gun. However, the greater relevance of the near term requirement resided in the fact that it was generated by the Marine Corps in conjunction with the Navy, and proved instrumental in starting off a reasonably funded program.

requirement to address capabilities that could support the operating range of the MV-22, communications connectivity, and target acquisition.¹¹⁴ The Marine Corps did not mention specific items of equipment or weapon systems in their requirements documentation. This was intentional as sea-based weapon system development is the Navy's prerogative. The Marine Corps is not concerned with the "how" as long as the Navy meets the requirement. Currently, the Marine Corps is satisfied with the direction of NSFS initiatives.¹¹⁵

Other key requirements have come to the fore regarding the joint nature of future conflicts and the implied need therein to support sustained operations ashore.¹¹⁶ This highlighted additional concerns regarding the ability of the near term program's ability to adequately address OMFTS.¹¹⁷ The Navy stood to benefit from these concerns as well as they provided the necessary ingredient, formal documentation, to compliment ongoing efforts to develop the follow-on systems to the improved 5" gun.¹¹⁸ Appendix E and F provide amplifying detail on NSFS requirements.

Long range close-in fires to compliment the movements of widely dispersed forces are key. Land based fires will continue to be required to provide very rapid, all weather suppressive fires. However, security and logistics requirements demand that these assets become progressively more sea-based and/or integral to maneuvering elements.¹¹⁹ Appendix C captures the changes in warfighting evolution that drive fundamental NSFS requirements.

¹¹⁴ Commanding General, MCCDC letter to the Chief of Naval Operations (OPNAV N86 and N85), 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996. The Marine Corps highlighted additional concerns regarding the ability of the near term program's ability to adequately address OMFTS.

¹¹⁵ Commanding General, MCCDC letter to OPNAV N86 and N85, 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996.

¹¹⁶ JHU/APL, *NSFS Road Map Study*, brief presented to OPNAV N864 (formerly N863), 1 April 1996.

¹¹⁷ Commanding General, MCCDC letter to OPNAV N86 and N85, 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996.

¹¹⁸ Kitchner, Roy, Lieutenant Commander, USN, NSFS Resource Sponsor (N864G4) on the OPNAV staff. Interview by author, 28 December 1996.

¹¹⁹ *A Concept for STOM*, 130, 133-134.

Current Program

The current program includes an improved 5" naval gun, or 5"/62, and a precision guided projectile referred to as the Extended Range Guided Munition (ERGM). Combined, they will provide accurate and lethal fires out to ranges in excess of 60 NM. There is also an ongoing experimental effort with a variety of missile systems to determine a viable missile candidate to compliment the gun system with even greater range and lethality. These include the Army Tactical Missile System (ATACMS), and a variant of Standard Missile, the current Navy surface-to-air defense missile. Other experimental efforts include two advanced technology demonstrations (ATDs) to accentuate the ERGM by simplifying the guidance package and fully taking advantage of the double ram capability of the 5" gun mount.¹²⁰ Appendix B details the characteristics of the following NSFS systems:

- 1) MK-45 Gun Mount Modification (5"/62)
- 2) Extended Range Guided Munitions (ERGM)
- 3) Best Buy ATD
- 4) Competent Munitions ATD

Future Initiatives

Future initiatives include the adoption of sea-based land attack missile like ATACMS or Standard Missile to compliment the 5"/62; Vertical Guns for Advanced Ships (VGAS) which is a bigger more capable gun system for follow on surface combatants; and improved

¹²⁰ NAVSEA Program Manager (PMS 429), *Naval Surface Fire Support: Program Overview*, Brief to Lieutenant General Paul K. Van Riper, Commanding General, MCCDC and Major General Hanlon, Director, Expeditionary Warfare Division (N85), OPNAV, 7 Oct 1996, 6. Here after referred to as NSFS: Program Overview, 7 Oct 96.

communications and target acquisition. Appendix B provides detailed descriptions of the following enhancements:

- 1) Army Tactical Missile System (ATACMS) Variants
- 2) ATACMS ATD (12 February 1995)
- 3) Sea-based ATACMS Concepts
- 4) Vertical Guns for Advanced Ships (VGAS)
- 5) VGAS Concept
- 6) Sea Standoff Land Attack Missile (Sea SLAM)
- 7) Standard Missile

Summary

Just as NGF was intrinsic to conventional amphibious operations, NSFS is intrinsic to OMFTS. However, OMFTS levies new technical challenges. These are chiefly greater range and lethality to accommodate: (1) greater initial standoff distance from shore, (2) greater inland penetration, and (3) sufficient firepower to mitigate the need for large quantities of land-based fire support.

CHAPTER 4

THE CURRENT PROGRAM; DOES IT MEET THE REQUIREMENT?

Can currently programmed NSFS, to include modifications to existing 5” guns, precision guided projectiles, and prospective follow-on land attack missile development, provide sufficient across-the-spectrum fire support for OMFTS operations? In light of the character of OMFTS and the recurring nature of low intensity conflicts, the answer is yes. However, there are some concerns.

Responsive Long Range Close-in Fires

The ERGM and missiles like ATACMS, though very fast compared to an artillery projectile, require significant time to travel ranges in excess of 40 NM, nominally five to ten minutes. Ground forces in contact are accustomed to the two to five minute responsiveness of artillery.¹²¹ Artillery is one of the most responsive fire support capabilities by virtue of its close proximity to ground forces. However, artillery also requires significant logistical support and protection which tends to run contrary to the intent of OMFTS. NSFS lends itself to deep shaping, but not close fires responsive to the committed maneuver element. As conceptualized, a sizable portion of fires are sea-based and positioned, at least initially, up to 25 miles or more offshore. Responsiveness could suffer during initial maneuver through insertion points while NSFS is still occupying positions 25 NM offshore. Responsiveness could also suffer during the later stages, if objectives are more than 40 NM inland. At least for the near future, responsiveness is a function of proximity.

Volume of Fire

¹²¹ JHU/APL, *NSFS Road Map Study*, brief presented to OPNAV N864, 1 April 1996.

There is a significant cost tradeoff in meeting volume of fire requirements and accommodating the longer ranges characteristic of OMFTS. Precision guidance is a prerequisite for accuracy at longer range. This adversely impacts availability of high volume suppression type munitions for those fires typically not planned and used to engage ill defined and located targets.¹²² The Marine Corps is concerned that the NSFS Program does not adequately address volume of fire. Volume of fire refers to the ability to fire substantial amounts of ordnance at a target. The degree of effects or lethality is largely a function of the amount of ordnance fired at the target. Suppressing targets requires less ordnance than destroying them.

The Marine Corps requirement for NSFS specifies that NSFS should be able to provide volume of fire equivalent to existing artillery.¹²³ Artillery is an area fire weapon. NSFS relies on precision guidance to hit targets with the first round.¹²⁴ The 5" ERGM¹²⁵ costs somewhere between \$20,000 to \$35,000 per round, depending on production rates.¹²⁶ A 155 millimeter dual

¹²² Both the IDA study and the COEA use clearly defined and established target sets which are clearly a prerequisite for the modeling and simulation used in comparative analysis. The obvious question is whether or not there is an associated tendency to neglect the significance of shock effect provided by less than precise fires delivered to relieve pressure or support maneuver (i.e. "suppressive fires"). In other words, do these fixed target sets form the basis for acquisition?

¹²³ Commanding General, MCCDC, Position paper developed to articulate the Marine Corps' near term NSFS requirement, C445. Subject: *The Marine Corps Requirement for Naval Surface Fire Support (NSFS)*, 3 November 1994.

¹²⁴ NSFS: Program Overview, 7 Oct 96.

¹²⁵ Chief of Naval Operations (N8). *Operational Requirements Document (ORD) for Extended Range Guided Munition (ERGM)*. The ERGM is a 5" projectile coupled with RAP and an internal Global Positioning System receiver and Inertial Navigation System (GPS/INS). In conjunction with modifications to the existing MK 45 gun mount, the ERGM is expected to achieve ranges at towards the higher end or objective range parameters required by the "near term" Marine Corps requirement. The warhead will carry 72 XM-80's submunitions. XM-80s are currently under development by the Army. They are roughly equivalent in lethality to the submunitions used in the current 155mm DPICM projectile, however they are smaller and therefore ideal for the relatively small 5" projectile, and contain a fail safe feature that will reduce the dud rate by a couple of percentage points. The current artillery submunitions dud rate is ~ 3-5%. The expected XM-80 dud rate is ~ 3%.

¹²⁶ Dennis G. Morral, Captain USN, *NSFS: Program Overview for MGEN Edward Hanlon Jr. (N85)*, Brief presented to OPNAV N85 and others by Captain Morral, NSFS Program Manager, NAVSEA, PMS 429, 7 December 1996, 10-12. Hereafter referred to as "NSFS Program Brief to N85, 7 Dec 96."

purpose improved conventional munitions (DPICM) artillery round costs between \$800 and \$1700, depending on the DPICM variant.¹²⁷ The predicament resides in affordability and validating the lethality of precision guidance which has not been seriously tested in combat. Declining budgets will likely dictate near term focus on the ERGM as opposed to a cheaper level of effort munitions. Cheaper ERGMs are not the entire answer. The Competent Munitions and Best Buy ATDs¹²⁸ focus on economizing the ERGM in the far term. If these ATDs payoff, the resultant technologies will go towards alleviating the volume of fire issue from a *cost per round perspective*. There will still be shortfalls in responsiveness with respect to time of flight, accommodating communications and targeting over greater ranges, and availability.¹²⁹

The ERGM is twice as big as the existing round, halving the rate of fire and storage capacity. The ERGM requires a double ram as opposed to a single ram for existing projectiles. In addition, the 5"/54 gun mount 600 round magazine capacity is at a minimum cut in half.

Mission Planning

¹²⁷ The 155 mm M483 DPICM round costs \$793.81, carries 88 dual purpose anti-armor/personnel bomblets, and has a range of 17.8 Kilometers (KM). The M864 DPICM round is the Rocket Assisted or RAP variant, costs \$1711.00, carries 72 dual purpose anti-armor/personnel bomblets, and has a range of 28KM.

¹²⁸ *NSFS Program Brief to N85, 7 Dec 96*, 13.

¹²⁹ LCDR Bernard Carter, N864G4, NSFS Resource on the OPNAV staff, interview by author, November 1996. The current magazine capacity of the MK 45 gun mount is 600 rounds. Not all of these rounds are allocated for NSFS. The 5" gun also serves as an anti-air/ship weapon. Special rounds are carried accordingly, though they do not amount to a significant portion of magazine space - typically 100-150 or so. The ERGM is roughly twice the size of the standard 5" round. Additionally, the existing 5" ballistic round is still highly useful for short range NSFS. In fact the minimum range of the ERGM is 10-15NM (per the ERGM ORD, see bibliography). To provide the complete range spectrum of fire support and accommodate the special rounds mentioned previously will significantly limit the number of ERGM rounds carried. Figures vary, but 150-200 ERGM rounds per 600 round magazine is a conservative estimate.

Fire support for Army and Marine Corps ground forces are integrated by a common mission planning system. NSFS does not presently include a compatible mission planning system.¹³⁰ For example, massing NSFS fires would require the coordination of a number of varied weapon systems widely dispersed over great distances. Subsequently, fire planning, direction, and coordination require inter-service software compatibility/interoperability so that observers, target acquisition devices like radar or unmanned aerial vehicles, and fire support coordination centers working ashore can directly communicate and transfer information to and from sea-based weapons platforms.¹³¹ The evolving NSFS effort should strive to integrate varied weapon systems, land, air, and sea-based, in such a manner as to mirror the seamless nature of OMFTS.

Communications and Targeting (C4I/Targeting)

Potentially, the greatest issue confronting NSFS is communications connectivity and targeting at OTH ranges. Most C4I/targeting efforts are being pursued in relative isolation without regards to total system connectivity and integration.¹³² To mass fires and achieve adequate volume of fire, C4I/targeting connectivity and interoperability is crucial.¹³³ On-call requests for fires require a communications capability on par with the range and reliability of satellite communications (SATCOM), but in sufficient quantity to support the small unit level.

¹³⁰ Naval Surface Warfare Center (NWSC), Dahlgren Division. *CJTFEX NSFS Digitization Demonstration Report*. 28 August 1996.

¹³¹ Commanding General, MCCDC to OPNAV N86 and N85, 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996.

¹³² JHU/APL, *NSFS Road Map Study Phase 1*, Status brief provided to OPNAV sponsors, April 1996, 13.

¹³³ Commanding General, MCCDC to OPNAV N86 and N85, 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996.

As higher unit cost per ERGM will keep numbers of weapon systems and munitions low, a more precise targeting infrastructure is needed to insure they are used in the most cost-effective manner. Precision guided munitions require an equally accurate target acquisition means in order to maximize lethality. ERGMs are very accurate compared to existing 5" ammunition. Fifty percent of the ERGMs fired at a target at 63 NM away will hit within a 20 meter circle.¹³⁴ In contrast, 50 percent of existing 5" rounds fired at a target 13 NM away will hit within a 360 meter oval.¹³⁵ The ERGM also employs a submunitions payload similar to artillery DPICM. This combined with greater accuracy considerably increases the lethality of a 5" projectile.

Unfortunately, the greater lethality achieved by a submunitions payload coupled with greater precision is dependent on a target located to within five meters. Currently, there are few, if any, targeting systems organic to ground forces that can achieve this degree of accuracy. The technology exists, but cost is a major factor. The Marine Corps plans to procure the Light Weight Laser Designator (LLDR).¹³⁶ However, the LLDR is only required to provide targeting accuracy to within 80 meters at six miles.¹³⁷ The LLDR is more accurate at closer ranges, but

¹³⁴ Chief of Naval Operations (N8), *ORD for Extended Range Guided Munitions (ERGM)*. 8 November 1995. 3. The Mk45 5"/54 has a maximum *effective* range of between 3 to 5 nautical miles and a maximum range of 13 NM. Lethality is roughly equivalent to that of a standard 105mm artillery HE projectile. With a 20 round per minute rate of fire, one 5"/54 gun mount is roughly equivalent to one 6 gun 105mm artillery battery. Accuracy is generally quantified via circular error probable (CEP) which according to JP 1-02 equates to the diameter of a circle in which 50% of the fired rounds will fall. CEP varies greatly with range. The CEP for the 5"/54 is approximately 360 meters at 13 NM. Beyond 13 NM, the 5" projectile is considered ballistically unstable. The 5" projectile is generally considered effective against soft area targets located on nearly relief free terrain where the rate of fire mitigates the relatively light destructive power of the individual round. Further specific information on the performance of 5" projectiles to include prospective advanced 5" projectiles like the ERGM, is included in a letter Naval Surface Warfare Center, Dahlgren Division, released in May of 95.

¹³⁵ The long axis of the oval in which the rounds land corresponds to the gun - target line. In contrast, the ERGM will be designed to dispense submunitions in a uniform manner or circle.

¹³⁶ Department of the Army. *Draft ORD for the Lightweight Laser Designator/Rangefinder (LLDR ORD)*. MCCDC, Quantico, VA., Undated. This is a joint Army and Marine Corps effort. Received a copy of the draft from corresponding Marine Corps requirements sponsor in November 1996. Here after referred to as "Draft LLDR ORD."

¹³⁷ *Draft LLDR ORD*, 5.

closer ranges tend to impose a greater requirement for speed of response which is already limited by the long ranges ERGMs will fire.

As NSFS continues to evolve, it will considerably enhance OMFTS operations. However there is still a small gap in capability heretofore provided by land based fires which NSFS will never completely close. This strongly argues for the maintenance of truly “all weather, all the time”¹³⁸ organic fire support like artillery and mortars directly responsive to the ground commander.

Summary

NSFS is evolving at an exceptional pace compared to other historical innovations in war fighting like Blitzkrieg, strategic air power, or the tank.¹³⁹ In the past seven years, NSFS progressed from the formal recognition of an operational deficiency in NGF through the development of the NSFS concept and, currently, to funding new systems specifically tailored to OMFTS. These include the development of improved 5” guns with precision guidance, and a variety of advanced technology experiments exploring even more powerful complimentary weapon systems. Unfortunately, advanced technology is more expensive than originally envisioned and presents a series of sequential hurdles. The chief among these is inter-service compatibility. For example, though the Navy is developing improved weapon systems to support of ground forces, they currently cannot design them to function exclusively off existing ship-based mission planning and targeting systems without encountering compatibility problems with the similar systems in development by the Army and Marine Corps.

¹³⁸ *NSFS: Program Overview*, 7 Oct 96, 3.

¹³⁹ James R. Fitzsimons and James M. Van Toll, *Revolution in Military Affairs*, *Joint Forces Quarterly*, (Spring 1994), U.S. Marine Corps Command & Staff College Theory and Nature Of War Readings (AY 96-97), Vol. V, 240.

CHAPTER 5

CONCLUSIONS

NSFS and NGF are two distinctly different capabilities, each molded by their respective times. NGF was particularly suited for World War II and to an ever decreasing degree afterwards. The newer NSFS concept is particularly suitable for the near future. The awesome NGF capability, of which most are familiar through second hand vicarious experiences such as film, was generated by the scope of World War II. The nature of the conflict demanded it. Large quantities of NGF ships poured tons of ordnance on the German and Japanese usually in support of large scale amphibious assaults. Once a foothold was established, NGF supported the landing force with both close-in fires and interdiction to prevent the enemy from effectively counterattacking. Like today, the threat was not accurately assessed beforehand. Large numbers of NGF ships did not exist at the start of the war; rather they were developed during its course.

The Cold War started with the end of World War II and changed the nature of conflict. Subsequent conflicts have not required a lot of NGF and the capability subsequently declined in accordance with the need for it. Both superpowers tailored their respective military capabilities to directly confront the other and ended up opposing each other via smaller peripheral conflicts. Furthermore, these conflicts were characterized by friendly access to the land area in contention before the conflict started. This reduced the need for massive amphibious assaults and validated the amphibious envelopment conducted in conjunction with friendly maneuver ashore. It also promoted the role NGF interdiction. Adversaries responded by employing more sophisticated coastal defenses grounded on anti-ship missiles and mines. This, combined with a Navy that was steadily downsizing from World War II, pushed NGF ships further out to sea and highlighted the need for greater NGF range.

With the end of the Cold War, the nature of conflict is in the process of another change. Recent experience suggests that current and near future amphibious operations will most likely be characterized by MOOTW. The flexibility and near surgical preciseness of NSFS, within the context of OMFTS, makes it uniquely suitable for MOOTW. MOOTW operations are characterized by a threat that tends to integrate itself within the confines of non-combatants for survivability. Once the threat is exposed, it must be engaged with surgical precision to minimize collateral damage and danger to non-combatants. The precision guidance and improved C4I/targeting associated with NSFS will provide firepower from ranges that provide a greater degree of survivability for naval ships confronted with sophisticated coastal defenses while providing fires that are sufficiently accurate to minimize collateral damage. At the same time, NSFS is sufficiently flexible to accommodate the greater firepower required by larger intensity conflicts through the synergistic effects provided by the coordinated employment of variety of very accurate systems.

The challenges that the naval services are confronting with the advent of OMFTS and firepower achieved by NSFS precision munitions versus firepower achieved by volume promote skepticism. This skepticism is characteristic of any new concept. However, this is a foolish and contradictory position considering the accuracy with which future threats have been predicted in the past. This skepticism is rooted in the lingering character of former conflicts. OMFTS blurs the boundary marking land and water by merging it into seamless maneuver space. Combining increased mobility, maneuver, and improved battlefield awareness, OMFTS engages adversaries by focusing on critical vulnerabilities to shatter cohesion and avoid costly attrition. This requires exactness in determining critical vulnerabilities, high mobility to maneuver faster than the enemy can react to protect them, and precision fires of NSFS to engage them. Effective NSFS is particularly crucial because coastal defenses project farther out to sea and higher mobility requires forces that are able to maneuver with smaller logistics tails.

Ongoing NSFS Initiatives are Particularly Suitable for OMFTS

The 5"/62 and ERGM supports initial OMFTS standoff fires to compensate for maneuver force's initial lack of indirect fire support. During subsequent operations ashore, the 5"/62 augments organic indirect fire support with long range close-in fires. Though the ERGM is expensive compared to existing artillery ammunition, it represents an affordable gap filler for tactical aviation and TLAM by providing a capability that is both accurate enough to hit well defined/located targets and cheap and plentiful enough to engage or suppress not so well defined ones.

Improved communications, mission planning and targeting will mitigate responsiveness issues posed by the longer ranges characteristic of OMFTS. By integrating the strengths of a variety of weapon systems, improved target acquisition and long range communications, targets will be identified much sooner, thereby lessening the TOF issue. A NSFS missile like ATACMS compliments the gun with greater range and lethality by engaging large area or hardened targets. VGAS offers a significant upgrade in range and lethality concurrent with the operationally cost-effective advantages of the 5"/62.

OMFTS Expanded Battlespace Drives NSFS Requirements & Developments

OMFTS portends expanded battlespace and the associated issues of: (1) a greater range spectrum on the order 200 NM, and (2) sea-basing more fire support to enhance the maneuverability of forces ashore. To accommodate this difference, NSFS must provide very accurate and lethal long range fires to support widely dispersed maneuvering forces. Furthermore, these fires must be available day and night and all the time.

A Mix of Systems is Required

Though the operational concept that drives NSFS is new, the combined employment of many weapon systems is not. Combined employment is crucial to NSFS because no single system can cover the expanded battlespace. In addition, new system development to meet the spectrum of needed fires is not realistically affordable in the era of military downsizing. NSFS efforts should continue to leverage existing systems like cruise missiles, artillery, and tactical aviation to fill in potential gaps in fire support encountered with new developments like the 5"/62, ERGMs, ATACMS, and VGAS. Each possesses a unique aspect of capability that fulfills a niche in the spectrum of NSFS requirements.

Close-in fires delivered from longer ranges are constrained by reduced responsiveness. NSFS cannot completely address the lack of responsiveness with naval guns and missiles. Therefore, tactical aviation and artillery will continue to fill a vital role in responsiveness throughout operations ashore to accommodate maneuver elements that have penetrated inland far enough to preclude timely sea based fires.

Controlling agencies must receive and respond to requests for fire with sufficient speed to support maneuver forces in contact. This also entails a commensurate ability to very rapidly and accurately acquire targets, route this information through the appropriate coordinating agency, and subsequently to weapon systems to maximize response time. Rapid feedback on target engagement is also critical and will serve to minimize wasted rounds. Automated mission planning and weapon system coordination will further increase responsiveness and perhaps mitigate the issue of longer times of flight.

Requirements are Well Defined

The NSFS requirement is well defined. The improved gun & ERGM are the first step. Other initiatives like ATACMS, VGAS, and C4I/Targeting provide an appropriate expansion in capability to improve range, responsiveness and lethality. In the past four to five years, a wealth

of studies have thoroughly examined a variety of options to include their likely cost-effectiveness. In turn, the Marine Corps has produced two definitive requirement's documents,¹⁴⁰ one for the near term and an updated version to accommodate operational mobility enhancements like the MV-22 and an integrated inter-service compatible mission planning capability. The near term requirement has transitioned into an acquisition program to produce the 5"/62 and ERGM. The updated version document is supporting the development of follow-on NSFS initiatives like VGAS and ATACMS.

Bottomline

Coordinating or massing the fires of many weapons is largely overlooked in the ongoing debate over the overall effectiveness of the 5"/62 gun and ERGM as well as follow-on candidate improvements such as ATACMS and VGAS in meeting NSFS requirements for OMFTS. This is compounded by a sense of impatience with regard to the time of fielding. It is also compounded by a fear of precision guidance as a replacement for volume. The near term program only represents the first installment. The Navy is serious about an NSFS missile and VGAS to complement the gun, but as with everything else the development of the systems is contingent on competing budget priorities. To mass fires and achieve adequate volume of fire, C4I/targeting connectivity and interoperability is critical. At this point in the development of a viable NSFS capability, this is where the Navy/Marine Corps focus should be. These shortfalls also strongly argue for the maintenance of truly "all weather, all the time" organic fire support (artillery & mortars) directly responsive to the ground commander.

¹⁴⁰ Commanding General, Commanding General, MCCDC to OPNAV N86 and N85, 3900 C44, subject: *NSFS for OMFTS*, 3 December 1996. The Marine Corps highlighted additional concerns regarding the ability of the near term program's ability to adequately address OMFTS and Marine Corps Combat Development Command (MCCDC), Requirements Division, *Near-term USMC NSFS Requirement*, 3 November 94.

APPENDIX A

ACRONYMS AND TERMINOLOGY

ADVFOROPS	Advance force operations. Refers to those available efforts conduct prior to an amphibious assault to prepare and shaping the Amphibious Area of Operations (AOA)
AMPHIB	Amphibious
AO	Aerial Observer
ATACMS	Army Tactical Missile System. The ATACMS was very successfully used during Desert Storm. Newer variants incorporate GPS guidance and varied payloads. The Navy has conducted two live fire demonstrations to validate the sea-based use of ATACMS. Ranges vary depending on the variant (90 to 150 NM). Payloads include submunitions and BAT.
ATF	Amphibious Task Force
AAAV	Advanced Amphibious Assault Vehicle. Follow-on to existing AAV or Amphibious Assault Vehicle.
ATD	Advanced Technology Demonstration
BAT designed	Brilliant Anti-Armor. BAT is a sensor fused submunition to engage armor. ATACMS, depending on the variant, can carry between 7 and 13 BATs.
C4I/Targeting	Command, Control, Communications, Computers, Intelligence and Targeting. A Collective reference to NSFS comminations, interoperability, mission planning, targeting, target acquisition
CCF	Call-for-Fire
CEP	Circular Probable Error.
CEB	CNO Executive Board
CNA	Center for Naval Analyses

CNO	Chief of Naval Operations
COEA	Cost and Operational Effectiveness Analysis
ERGM	Extended Range Guided Munition
FOC	Full operating capability
FSCL	Fire Support Coordination Line
FSCM	Fire Support Coordination Measure
FYDP	Fiscal Year Defense Program
FS	Fire Support
GAO	Government Accounting Office
HELO	Helicopter
ID	Identification
IDA	Institute for Defense Analysis
IOC	Initial Operating Capability
LCAC	Landing Craft Air Cushion
Littorals	That area encompassing the coastal water regions of the world where most of the global population resides. In the past 10 years, the maritime services have conducted countless operations in the littorals. This seems to indicate that population density has a direct correlation with the frequency of conflict. Evolving operational concepts like OMFTS are designed to tailor future maritime forces to respond to the increasing likelihood of operations in the littorals.
LSD	Landing Ship Dock
LZ	Landing zone
MCAC	Multi-Mission Craft Air Cushion. Refers to the counter-mine variant of LCAC
MCCDC	Marine Corps Combat Development Command, Quantico, Virginia

MNVR	Maneuver
MOA	Memorandum of Agreement
NM	Nautical mile. Approximately 1.14 miles or 1.8 kilometers.
NSFS	Naval Surface Fire Support
NSWC	Naval Surface Warfare Center
OBJ	Objective
OPS	Operations
ORD	Operational Requirements Document
OTH	Over-the-Horizon.
PGM	Precision Guided Munitions
RQT	Requirement
SACC	Supporting Arms Coordination Center. Refers to the ATF fire support coordination center afloat. Managed by the SAC or Supporting Arms Coordinator.
SACCEX	Supporting Arms Coordination Exercise
STOM	Ship-to-Objective Maneuver
TLAM	Tomahawk Land Attack Missile. This is a U.S Navy cruise missile launched from existing surface combatants. Ranges exceed 1000 NM and accuracy is pin-point. There are several different payloads to engage a variety of targets. Its primary mission is strategic strike. In light of the current emphasis on “Littoral” warfare, the Navy is reviewing the merits of using existing variants and/or developing somewhat less sophisticated tactical variants in direct support of ground forces.
UAV	Unmanned Aerial Vehicle
VLS	Vertical Launch System
MLRS	Multiple Launch Rocket System

M270

The tracked, tank-like vehicle that transports MLRS

Sea SLAM

Surface combatant launched variant of the Standoff Land Attack Missile or SLAM

APPENDIX B

WEAPON SYSTEMS

Weapon systems are by far the most interesting to discuss. At the same time, the weapon system or systems is probably the one aspect the least in need of helpful prodding. A quick glance at program funding justification documents indicates an overwhelming emphasis on prospective weapons system development. Funding profiles, though on the order of 3 or 4:1 in favor of weapons over C4I, though this is not necessarily an accurate indicator of disparity because weapons are inherently more expensive.¹⁴¹

WEAPON SYSTEM DESCRIPTION

MK-45 5" naval gun (5"/54)

The Mk45 5"/54 has a maximum *effective* range of between three to five NM and a maximum range of 13 NM. Lethality is roughly equivalent to that of a standard 105mm artillery HE projectile. With a 20 round per minute rate of fire, one 5"/54 gun mount is roughly equivalent to one 6 gun 105mm artillery battery. Accuracy is generally quantified via circular error probable (CEP) which according to JP 1-02 equates to the diameter of a circle in which 50% of the fired rounds will fall. CEP varies greatly with range. The CEP for the 5"/54 is approximately 360 meters at 13 NM. Beyond 13 NM, the 5" projectile is considered ballistically unstable. The 5" projectile is generally considered effective against soft area targets located on nearly relief free terrain where the rate of fire mitigates the relatively light destructive power of the individual round. Further specific information on the performance of 5" projectiles to include prospective advanced 5" projectiles like the ERGM, is included in a letter Naval Surface Warfare Center, Dahlgren Division, released in May of 95.

2. MK-45 Gun Mount Modification (5"/62)

5"/62s start fielding in 2001 and will culminate with a total of up to 27 by 2010. The 5"/62 is essentially the same gun mount as the 5"/54 with modifications to the gun tube and fire control system. The modification essentially changes something with the MV of a .45 caliber pistol to something like a 30.06. The mount itself is reinforced to accommodate the higher muzzle energy of the ERGM. The fire control system is modified to program the ERGM with geographical data to tell it where it is shooting from and what the target location is. Technically, the 5"/62 is a modification as opposed to a new system. This lowers the overall cost by permitting the use of existing gun mounts. Cost is further reduced by forward fitting the 5"/62 on DDG-51 Class Destroyer while they are still on the production line. A modification also

¹⁴¹ Bernard Carter, Lieutenant Commander, USN. NSFS Resource Sponsor (N864G4) on the OPNAV staff. Interview by author, November 1996.

offers the opportunity to retrofit the 5"/62 on existing ships. Each gun modification costs approximately \$5 - 8 million.¹⁴²

3. Extended Range Guided Munition (ERGM)

The ERGM is a new 5 inch projectile that incorporates an inertial navigation system (INS) augmented with a global positioning system (GPS), a rocket assisted motor (RAP), and a submunitions payload similar to the current artillery Dual Purpose Improved Conventional Munition (DPICM). Since existing 5"/54 ammunition is ballistically unstable beyond its maximum range of 13 NM, designers added GPS/INS to maintain accuracy over increased range. Moreover, addition of a rocket motor and little wings or canards and further ranges can be achieved. GPS/INS also provides precision or Circular Probable Error (CEP) on the order of 20 meters at 60 NM, a significant improvement over existing ballistic ammunition with CEPs on the order of 360 meters at 13 NM. An ERGM will cost approximately \$20,000 to \$30,000.¹⁴³ Though it is expensive, the ERGM purports to reduce overall costs by significantly limiting the number of rounds required to hit a target. Similar logic suggests that overall logistic requirements will shrink as well because more effective sea based fires limit the amount of artillery required ashore.¹⁴⁴

The flight profile of the ERGM is very different from conventional artillery or existing naval gun ammunition. In fact, it more closely resembles a small guided missile. When the ERGM leaves the gun tube, it locates itself via GPS/INS which in turn guides it along a pre-calculated flight path to the target. The maximum ordinate at 60 NM is approximately 80,000 feet. This provides sufficient altitude for the ERGM to glide for great distances.¹⁴⁵

4. Competent Munitions ATD

This is one initiative that is underway to try and bring down the cost per round. It is based on the concern, that at the going price for ERGM may limit ERGM employment. It is centered on developing a combination fuse and guidance system that fits a standard NATO fuse well. Adapting this capability to existing artillery ammunition is also considered a possibility.¹⁴⁶

¹⁴² Carter, Interview by author, November 1996.

¹⁴³ Carter. In contrast, a 155mm artillery DPICM round costs \$800-1700 a copy depending on the conventional or RAP variant.

¹⁴⁴ NSFS: Program Overview, 7 Oct 96, 6-8.

¹⁴⁵ NSFS: Program Overview, 7 Oct 96, 9.

¹⁴⁶ NAVSEA Program Manager (PMS 429). *Naval Surface Fire Support: Where We Are. Where We're Going. Dr. Paris Genalis and Mr. George Kopcsak*, Program brief to Dr. Genalis and Mr. Kopcsak, Office of the Secretary of the Navy (OSD), August 1996, 11. Here after referred to as NSFS: Program Overview, Aug 96.

5. Best Buy ATD

The 5"/54 gun mount was originally designed to load ammunition in two parts or double ramming. Current ballistic ammunition is a single ram process. Firing the ERGM is a double ram process. The first ram loads the projectile and RAP motor and the second loads the powder increment, however, the second ram only partially uses the space available. This ATD is exploring means to maximize the space available in the second ram to accommodate a larger RAP motor and provide more range or put in more submunitions for greater lethality. The technical hurdle is designing a mid-body joint that connects both pieces in the tube in a strong enough manner to maintain projectile integrity at launch and beyond.¹⁴⁷

6. Advanced Tactical Missiles System (ATACMS)

ATACMS is an existing Army missile system fired from the M270 Launcher, the same launcher currently used for the Army Multiple Launch Rocket System (MLRS). The Army is pursuing a several variations with different ranges and payloads. The Navy is exploring a sea-based variant of ATACMS employing submunitions payload.¹⁴⁸ Though there are other candidates like Standard Missile and Sea Slam, ATACMS is generally favored for its better combination of range and payload characteristics.

The naval variant is the Block 1A with GPS/INS, a 150 mile plus range, and slightly modified to fit into the Navy's Vertical Launch System (VLS).¹⁴⁹ VLS is the Navy's standard launch system for almost all surface ship launched missiles. The Army pays roughly \$450,000 to \$600,000 per land-based variant of the Block 1A. Ship launch variants will be more expensive initially, \$600,000 to \$900,000, because some modification is required with respect to the guidance system. A ship is always moving in three dimensions whereas the M270 Launcher moves in two dimensions.¹⁵⁰

7. Vertical Guns for Advanced Ships (VGAS)

This is, in essence, two vertically mounted 155milli-meter guns in a box that also serves as the magazine. VGAS offers ranges around 150 miles with a high rate of fire and considerably more lethality than the 5" gun. Why are they vertically mounted? One of the reasons the trajectory of the 5"/62 is so high is to get the projectile up to altitudes where air friction is considerably reduced thereby enhancing glide and consequently range. Vertically mounted guns

¹⁴⁷ NSFS: Program Overview, Aug 96, 12.

¹⁴⁸ Laughlin, J.P., Vice President, Deep Attack Programs, Loral Vought Systems letter to Vice Admiral T.J. Lopez, Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessments (OPNAV N8). 26 March 1996.

¹⁴⁹ Loral Vought Systems. *Joint Power Projection2.NAVY TACMS2.From the Sea*. A brief provided to OPNAV N85, 15 August 1995.

¹⁵⁰ OPNAV N863. *Naval Surface Fire Support*. A brief to the Ground Maneuver Joint Warfare Capabilities Assessment (JWCA). 21 December 1994.

send a projectile into this part of the atmosphere much more quickly. Currently, the VGAS initiative is exploratory and being conducted in conjunction with the Arsenal Ship ATD.

VGAS is particularly lucrative, not so much because of greater range and lethality, but because it is a modular concept that is similar in size to the standard 64-Cell Vertical Launch System (VLS).¹⁵¹ There is considerable flexibility resident VGAS as it could be readily exchanged with VLS boxes on existing ships. It also conforms to the Navy's desire to reduce radar cross signature (RCS) by limiting the amount of antennas and various gadgetry that sticks up from a ship to maximize stealth.¹⁵²

The NSFS COEA determined; that given the nature of targets likely to be encountered in OMFTS operations and assuming the level of conflict would not exceed two MRC level conflicts over a 20 year period, an advanced 155mm caliber gun in conjunction with TLAM was the most cost-effective option.¹⁵³ A greater level of intensity, larger guns, 8 inch and up, performed more operationally and cost-effectively.¹⁵⁴

VGAS is being considered for the next generation destroyer or Surface Combatant 21 (SC-21). The VGAS initiative is currently one of several exploratory concepts being studied for the Arsenal ship initiative. If the concept is validated and the Arsenal ship becomes reality, VGAS will become reality. If it doesn't, but the concept is still viable, then it could be included on SC-21.¹⁵⁵

¹⁵¹ NSFS: Program Overview, Aug 96.

¹⁵² NSFS: Program Overview, Aug 96.

¹⁵³ CNA, *NSFS COEA Final Report*, CNR 210, October 1994, 3.

¹⁵⁴ CNA, *NSFS COEA Final Report*, CNR 210, October 1994, 3-6.

¹⁵⁵ NSFS: Program Overview, 7 Oct 96, 19-20.

APPENDIX C

WAR FIGHTING EVOLUTION¹⁵⁶

Current

Long MCM OPS/pre-assault suppression

Improved mine hunting reconnaissance will help determine where the location of gaps or sparsely seeded areas.

Amphib/FS ships OPS ~2 NM from coast

A 25 NM standoff range is an implicit requirement in the development of the tools to support OMFTS.

Large lift rqmnts (FOE/arty)

Logistics transfer ashore

The sea-based logistics concept reflects the recognition to significantly reduce the logistics footprint ashore to accommodate the maneuver speed and tempo of OMFTS.

LZs limited by helo & FS range

The maximum range of existing NSFS is 13 NM. The near term NSFS range requirement is based on the range of existing artillery or about 30 KM. MV-22 will have an operating range of 200 NM. This clearly suggests the need for a greater NSFS requirement and an associated targeting capability.

Support Marine Corps

Evolving

Avoids mines & fixed defenses

Amphib/FS ships OTH standoff

Reduce lift/increase sea-based FS

Sea-based logistics

LZs deep to support MNVR & precision targeting

Support joint land battle

¹⁵⁶ JHU/APL, *NSFS Road Map Study Phase 1*, A status brief provided to OPNAV sponsors. April 1996. Slide 8. The portions in italics are taken directly from the slide. Clarifying comments are provided in parenthesis. This study was directed by OPNAV N85/N86 in early 1994 to develop an NSFS “master plan” to include a notional acquisition scheme. Recently, its taken on a decidedly joint flavor in recognition of limited resources and compatibility issues surrounding the nature of NSFS as a system of systems in conjunction with its likely roles in future joint and combined operations. Phase 2, war-gaming and modeling, is ongoing.

Unilateral service operations are increasingly rare due to growing service interdependence and the effectiveness of Joint Operations.

Limited duration/intense OPS

*Maybe long duration,
sustained & simultaneous OPS*

Historical U.S. populous predilection casualties and involvement in long duration military evolution's overseas without clear relation to interests.

Limited geographic area

Expanded battle space

Technology is rapidly expanding areas of influence.

APPENDIX D

EVOLUTION OF THE NSFS PROGRAM (1991-1996)¹⁵⁷

Dec 1991	National Defense Authorization Act for FY1992 - 1993 directs the Navy and the OSD to assess NSFS needs and the Navy to conduct the NSFS COEA.
May 1992	Navy approves NSFS MNS. C current systems lack range/accuracy to support evolving operational concepts like OMFTS/FFTS.
July 1992	Navy issues its first congressionally mandated report on NSFS requirements.
Sept 1992	FY93 Congressional language indicates authorization committee supports NSFS program, however appropriation does not.
Feb 1993	Navy initiates NSFS COEA.
Jun 1993	IDA completes independent assessment of NSFS. Most cost effective near term weapon mix is a combination of advanced projectile compatible with existing 5” gun and a ship launched variant of ATACMS. ¹⁵⁸
Sep 1993	FY94 Congressional Authorization Committee continues to show support, however, not reflected in appropriation language.
Mar 1994	CNA completes NSFS COEA. Existing tactical use of TLAM and a new 155mm/60 caliber gun with advanced propellant and a family of rocket assisted PGMs is the most cost effective option per the 1994 COEA. Accordingly, Navy proposes NSFS program and funding in 1996-01 FYDP.

¹⁵⁷ OPNAV N86, *Chronology of Major NSFS Events*, February, 1996. An abbreviated point paper genesis of key events that occurred in the development of the current NSFS Program. This document was very helpful in comprehending the sequence and relationship of studies or reports and consequent developmental decisions. This appendix provides a more detailed and updated version of this chronology.

¹⁵⁸ IDA, *Assessment of Alternative Ship-to-Shore Fire Support Systems*, June 1993, IDA Report R-387, Report documentation page.

Aug 1994	Navy restructures NSFS program in light of funding shortfalls and defers 155mm/60 caliber gun development. Existing platforms cannot support weight of 155mm gun mount without cost prohibitive modification. Issue exacerbated by 4-6 year development period for 155mm.
Sep 1994	FY95 Congressional Appropriation Committee language cuts FY95 NSFS budget.
Oct 1994	NSFS plan to modify existing 5" guns and conduct candidate missile demonstrations briefed to the CEB. CNO expresses concern with timeliness of plan and questions basis for range requirement. CNO directs; (1) focus on near term improvement, (2) use existing systems and deliver prior to 2001, (3) Navy/Marine Corps to re-examine range requirement and get back to him.
Nov 1994	MCCDC produces NSFS Requirement position paper: (1) 41 NM minimum (threshold) range and 63 NM maximum (objective) range. Volume of fire and lethality should be equivalent to artillery.
Dec 1994	Revised NSFS plan briefed to CEB. CNO approves plan. Improve capability within the FYDP (IOC by FY2001). Plan represents a step in the right direction vice complete solution. Develop NSFS "Campaign Plan" (subsequently termed "APL Road Map") for mid-term and future requirements, and how to get there. Principal elements: <ul style="list-style-type: none"> - Improvements to existing 5" gun systems (structural modifications, advanced propellants) - ERGM development (RAP, GPS/INS, submunitions) - Continue Strike missile demo's - Leverage/integrate C4I systems
Dec 1994	COEA formally released for distribution with exception of Congress. Results had been available for some time. Concern over potential delay in program execution over possible confusion regarding intention to forgo 155mm in favor of 5" gun because of cost constraints. Also, CNO directed improvement by 2001. COEA not confined by cost and analyzed potential solutions for 2003 time frame.
Jan 1995	CNO formally issues program guidance to pursue upgrades to existing 5" guns and development of PGM.
Feb 1995	First of missile demonstrations conducted. ATACMS mounted on <i>USS Mount Vernon</i> (LSD 39) successfully fired 75 NM at San Clemente Island.

Mar 1995	Navy tasks CNA to conduct supplemental analysis to 1994 NSFS COEA to examine the feasibility of improving existing guns and missiles instead of developing a “new” system. Navy establishes formal NSFS Program Office at NAVSEA as executor of CNO plan.
April 1995	SECNAV signs NSFS plan approved by CNO and CMC.
May 95	Marine Corps and Army MLRS MOA approved. Army will augment Marine Corps with MLRS support as available. ¹⁵⁹
	GAO releases report declaring that Navy NSFS plan is not consistent with published studies, namely NSFS COEA, and recommendation to build 155mm guns vice modifying existing 5”guns.
	Navy forwards a NSFS report to congress outlining the current NSFS plan and vision.
Sep 1995	FY96 Congressional language on both sides (Authorization and Appropriations) in agreement on NSFS progress. Funding deficiencies jeopardize FY2001 IOC.
Oct 1995	Congress provides \$22,000,000 in additional funding for FY 96 to put program back on track for FY2001 IOC.
Feb 96	Navy awards improved MK45 (5”/62) contract. ¹⁶⁰
Apr 96	Navy conducts Sea Slam demonstration. ¹⁶¹
Sep 96	Navy awards ERGM contract.

¹⁵⁹ Deputy Chief of Staff for Plans, Policy, and Operations, USMC and Deputy Chief of Staff for Operations and Plans, USA. Memorandum of Agreement (MOA). subject: ***Memorandum of Agreement between the United States Army and the United States Marine Corps; Army Multiple Launch Rocket System (MLRS) support to the Marine Corps.*** 26 May 1995. The Marine Corps and Army agreed that the Army can provide MLRS support to augment Marine Corps artillery. Unfortunately, assuming the Army could spare the assets, limited amphibious assault shipping nearly precludes Army MLRS from participating in the vulnerable ship-to- objective maneuver phase.

¹⁶⁰JHU/APL, ***NSFS Road Map Study Status Brief to Jean Reed***, Brief provided to Jean Reed, Congressional Staffer and OPNAV sponsors, 8 October 1996, 3.

¹⁶¹ Russo, Mark, Major, USMC, NSFS Requirements Sponsor (N853G) on the OPNAV N85 staff. Interview by author November 1996. Other documentation mentioned the CNO’s intent to include Sea SLAM in missile shoot-off that included ATACMS, Standard Missile, and Sea SLAM. The question was whether or not this had occurred.

Nov 96 Navy conducts ATACMS demonstration at White Sands to validate VLS compatibility¹⁶²

Dec 96 MCCDC formally provides updated NSFS requirements to complement existing Program efforts including improved C4I/targeting and volume of fire. This supports OPNAV POM efforts to acquire additional funding for a NSFS missile and a VGAS ATD.

¹⁶² Vice President - Deep Attack Programs, Lockheed Martin Vought Systems letter to Director Expeditionary Warfare (N85), No subject (*ATACMS VLS Demonstration*), 11 December 1996. This letter summarizes the successful firing of an ATACMS from a land based Vertical Launch System (VLS) at the White Sands Missile Test Range in New Mexico on 21 November 1996.

APPENDIX E

NSFS OPERATIONAL AND PROGRAMMATIC REQUIREMENTS¹⁶³

Operational Requirements

- 1) Responsiveness that is at least as responsive as land-based artillery is today exclusive of time of flight.
- 2) Supplement air and other strategic assets in engaging enemy weapons and strategic targets at relatively long range limiting the enemy's ability to engage friendly forces
- 3) Counter-engage and "defeat" (not totally destroy) enemy systems that can impair own force operational capability or inflict casualties during the "landing" as responsively as land-based artillery exclusive of time of flight.
- 4) Operate in a dedicated role.
- 5) Provide fire support until landing force artillery is phased ashore.
- 6) Supplement landing force artillery when established ashore.
- 7) Support sustained ground combat joint and combined operations.
- 8) Longer range to support MV-22 landing zones.

Programmatic Requirements (Operational requirements translated into programmatic improvements)

- 1) Weapon systems effectiveness which includes: range and lethality. Lethality further breaks down into precision, volume of fire, and warhead mix.
- 2) Communications which includes: connectivity over greater ranges and inter-service compatibility.
- 3) Target acquisition which includes target location accuracy via a variety of means not limited to the ground observer.

¹⁶³ Compiled from a variety of sources. See the "Requirements" section in the bibliography.

APPENDIX F

HISTORICAL CHRONOLOGY OF NGF/NSFS RANGE REQUIREMENTS

The most emphasized NSFS requirement is range. Studies encompassing the last twenty years indicate that ranges in excess of 50 NM will be the norm for future NSFS requirements. Significantly smaller naval forces in concert with the growing sophistication of mines, anti-ship defenses, and long range interdiction form the basic premise for these ranges. OMFTS adds the feature of flexibility and responsiveness on par with the firepower organic to ground forces. During the October 1994 CEB, the CNO expressed concern over the apparent lack of justification for ranges on the order of 75 NM and subsequently directed the Navy and Marine Corps re-examine the range requirement.¹⁶⁴

1977:	19 - 49 NM ¹⁶⁵
1990:	40 - 60 NM ¹⁶⁶
1992:	50 - 75 NM ¹⁶⁷
1992	NSFS MNS specifies OTH ranges ¹⁶⁸
1993	75 - 100 NM ¹⁶⁹
1994:	NSFS COEA ~40-90 NM not specified, though implied in recommended candidate weapon system capabilities ¹⁷⁰
1994:	41-63 NM ¹⁷¹

¹⁶⁴ CEB. *Naval Surface Fire Support*. 3 October 1994.

¹⁶⁵ Weller, 9.

¹⁶⁶ Headquarters, U.S. Marine Corps. *Department of the Navy Integrated Amphibious Operations and USMC Air Support Requirements*. January 1990. 50-51. See bibliography.

¹⁶⁷ NWSC, Dahlgren. *NSFS Study*. July 1992. 2-7 to 2-10.

¹⁶⁸ *NSFS MNS*, 1992.

¹⁶⁹ IDA, *Assessment of Alternative Ship-to-Shore Fire Support Systems*, June 1993, IDA Report R-387, 41.

¹⁷⁰ Director, Requirements and Advanced Systems Division, CNA letter to MGen Harry W. Jenkins, Jr., Director, Expeditionary Warfare Division (N85) and others. CNA 93-2558, subject: *Guns, Missiles and Clubs*. 15 December 1993.

1996: ~200 NM to support operational range of MV-22¹⁷²

¹⁷¹ Commanding General, MCCDC, Position paper developed to articulate the Marine Corps' near term NSFS requirement. C445. Subject: ***The Marine Corps Requirement for Naval Surface Fire Support (NSFS)***. 3 November 1994.

¹⁷² Commanding General, MCCDC. Letter to OPNAV N85, Director, Expeditionary Warfare and N86, Director, Surface Warfare. 3900 over C44. Subject: ***Naval Surface Fire Support for Operational Maneuver from the Sea***. 3 December 1996.

BIBLIOGRAPHY

1. PRIMARY SOURCES

A. STUDIES. There are three studies of particular value in gaining an appreciation of the relationship between technology, weapon systems, and OMFTS. These are: (1) the *1993 Assessment of Alternative Ship-to-Shore Fire Support Systems*, (2) the *1994 NSFS COEA Final Report*, and (3) the *1995 NSFS Study: Near-Term Improvements to Existing Guns and Missiles*. These studies are marked with an asterisk. Some of the following documents are classified Secret or Confidential, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified. Those portions relevant to the derivation of NSFS requirements are unclassified. In fact, it is not atypical for well over 90% of such a document to be unclassified.

Center for Naval Analyses (CNA). *Preliminary Tradeoff Analysis of Existing and Near-Term NSFS Weapon Systems*. March 1993. CRM 92-129. (This document is classified Secret, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.) This study compares the effectiveness of modified existing weapon systems and potential new systems. The study is clearly dominated by “new” systems. One of the standing anomaly’s of preparing for war is the competing relationship between war fighting requirements and available resources. Typically, once a need is voiced, there is no lack of potential solutions, particularly those that entail new production and the commensurately lucrative opportunities that presents for defense contractors. This study illustrates this point.

CNA. *NSFS Weapon Options/System Issues*. May 1994. CRM 94-8. (This document is classified Secret, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.) This study is very similar in content to the previous one: *Preliminary Tradeoff Analysis of Existing and Near-Term NSFS Weapon Systems*. In fact, it appears to be an update published to coincide with a particularly sticky POM evolution (see Appendix D, “Evolution of the NSFS Program”).

* CNA. *NSFS COEA Final Report*. October 1994. CNR 210. (This document is classified Secret, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.) The NSFS COEA concludes 155mm naval guns (no technical relationship to 155mm howitzers) and the TOMAHAWK Land Attack Missile (TLAM) provide the most cost and operationally effective solution. There were several other naval gun caliber’s assessed to include the light weight 8” gun, however, within the context of the parameters defined for the study, the 155 mm gun surpassed all competitors. This report addresses both the technical and operational

aspects of NSFS. In the gamut of studies attempting to quantify the NSFS requirement, this is probably the most thorough and well rounded one.

* CNA. *NSFS Study: Near-Term Improvements to Existing Guns and Missiles*. 31 July 95. CNA 95-0147.09. (This document is classified Secret, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.) As a result of the incompatibility of the 155mm gun on existing and newer class ships such as the Arleigh Burke Class Destroyer (DDG-51) and the time it would take to wait for a completely new follow-on a ship like the Twenty 1st Century Combatant (SC-21), OPNAV N86 directed CNA to analyze the utility of modified 5" guns and a precision guided projectile as an short term interim improvement. CNA concluded that precision guided projectile development should be pursued without the associated cost of modifying the gun. Their rationale was that, in light of the intention to provide further improvements in the future, it was cheaper to develop a long range projectile without the additional cost of modifying the gun. This study provides an excellent description of precision guidance applied in a 5" naval gun projectile.

CNA. *NTACMS Versus Standard Missile for NSFS: Final Briefing* September 96. (This document is classified Secret, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.) NTACMS stands for "Navy Tactical Missile System," or a sea-based version of ATACMS. The CNO, as a part of his guidance following the 14 December 1995 CNO Executive Board (CEB), directed the Navy to proceed with shipboard test launches of ATACMS, Sea SLAM, and Standard Missile to evaluate their potential in NSFS roles. CNA concluded that both Standard and ATACMS were on par and only further testing within the context of a clearly defined NSFS missile requirement would yield an obvious winner. This is an excellent "single source" reference for a comparative analysis of all the lead NSFS missile concepts.

CNA. Memorandum for Major General H. W. Jenkins (N85) and Mr. Ronald Kiss (DASN (Ships)), Co-Chairs, NSFS COEA. Subject: *Naval Surface Fire Support (NSFS) COEA*. 14 January 1994, 05 94-0111. This letter was provided in response to concerns expressed over the appearance within the 1994 NSFS COEA scenarios that tactical aviation performed a minor role relative to guns and missiles. CNA concluded that operational considerations would determine the extent of tactical aviation participation. This document reinforces the premise that no single "weapon system" can completely satisfy NSFS requirements. It also provides a comprehensive review of both cost and operational factors affecting the use of tactical aviation.

Government Accounting Office (GAO): *NSFS: Navy's Near-term Plan is Not Based on Sufficient Analysis*. May 1995. GAO reports are usually directed by Congress to provide a "second opinion" on a budget issue. The release of this report coincided with OPNAV's POM 1996 submission for NSFS. It was initiated to address the dichotomy between previous analysis in the 1994 NSFS COEA that supported the 155mm naval gun and the Navy's more recent intention to pursue the improved 5"/54. Dichotomy aside, the GAO

study compiles the substance of nearly all the previous NSFS studies as well as broad programmatic stratagem in a single document.

Headquarters, U.S. Marine Corps. ***Department of the Navy Integrated Amphibious Operations and USMC Air Support Requirements*** (Note: This document is classified “Secret”, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as “unclassified.”). January 1990. This document is used as a planning guide to calculate Marine Corps amphibious lift requirements in various scenarios. It is frequently referenced in POM cycles to justify budget submissions. Its significance lies in a brief section addressing NSFS requirements, specifically, comments to the effect that, an “NSFS system that provides fires out to roughly 60 nautical miles is required to support future OTH operations.” This is particularly interesting because it clearly suggests Navy and Marine Corps planners were considering the issue of NSFS and OMFTS before there were even names to describe these concepts.

* Institute for Defense Analyses (IDA). ***Assessment of Alternative Ship-to-Shore Fire Support Systems***. (Note: This document is classified “Secret”, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as “unclassified.”). June 1993. IDA Report R-387. The National Defense Act for FY1992-93 directed the Office of the Secretary of Defense (OSD) to conduct an “*independent study of naval ship-to-shore fire support requirements.*” IDA concluded that the best near NSFS solution was a new GPS/INS projectile fired from the existing 5”/54 in conjunction with a Vertical Launch System (VLS) variant of ATACMS. The significance of this study lies in the fact that it emphasizes the need for a long range NSFS missile to compliment an improved naval gun regardless of the caliber.

Naval Surface Warfare Center (NWSC), Dahlgren. ***NSFS Study***. July 1992. This document was included in a congressionally directed 1992 report on NSFS. This report also addresses likely future NSFS requirements within the context of OTH amphibious operations. Of particular note, is that it describes a notional 75 NM NSFS range requirement that was based on a Soviet Motorized Rifle Division “styled” beach defense. It appears that even the Navy’s research and analysis centers were equally at a loss to describe the post Cold War threat.

Naval Studies Board National Research Council. ***The Navy and Marine Corps in Regional Conflict in the 21st Century***. June 1995. A particularly interesting report with an aviation slant that generally concludes that NSFS is vital to the continued viability of tactical aviation. Specifically, it suggests that low to mid altitude bombing may become a thing of the past in light of the plethora of cheap and effective air defense systems available on the international market. As a result, long range ship launched precision guided munitions (PGMs) may play an instrumental role in providing long range SEAD for tactical aviation in the future.

Secretary of the Navy (SECNAV) Report to Congress on NSFS. July 92. This report was submitted by the Secretary of the Navy (SECNAV) in response to the National Defense Authorization Act for FY1992 and 1993. It includes a requirements analysis performed by the Navy Sea Systems Command (NAVSEA). In addition to previously mentioned

comments on the “75 NM range requirement,” the report identifies several new technologies that would support development an NSFS system capable of engaging a spectrum of threats opposing future amphibious operations. Though the information therein pre-dates other more recent work, it helps to put current programmatic decisions in perspective.

SECNAV Report on the NSFS Program Plan. April 1995. This document forms the basis for the current program and formally articulates the Navy’s intention to pursue the improved 5”/62 and ERGM instead of the 155mm gun recommended in the *1994 NSFS COEA*. The report was submitted by SECNAV in response to a congressional request for an integrated NSFS program plan to include funding schemes for improvements and how the fielding of these improvements coincided with the MV-22 and AAV. This report provides an indication of how much the conclusions of previous studies are influenced by existing fiscal constraints.

B. INTERVIEWS. Interviews provided a comprehensible context from which to absorb all the NSFS studies and plans used in the development of this paper.

Carter, Bernard, Lieutenant Commander, USN. NSFS Resource Sponsor (N864G4) on the OPNAV staff. Interview by author, November 1996.

Kitchner, Roy, Lieutenant Commander, USN. NSFS Resource Sponsor (N864G4) on the OPNAV staff. Interview by author, 28 December 1996. Roy Kitchner assumed Bernie Carter’s duty when he transferred.

Russo, Mark, Major, USMC. NSFS Requirements Sponsor (N853G) on the OPNAV staff. Interview by author November 1996.

C. DOCUMENTARIES. These documentaries are predominantly lap-top briefs that were provided to flag level decision makers. They help put the evolution of NSFS within perspective, particularly with regard to future intentions.

Chief of Naval Operations Executive Board (CEB). ***Naval Surface Fire Support.*** A briefing provided to the Chief of Naval Operations by the Director, Surface Warfare Plans, Programs and Requirements Branch (N863). 3 October 1994. Key decisions included the consensus that the 155mm naval gun proposed by the *1994 NSFS COEA* was too expensive and even assuming funding was available, could not be accommodated on existing ships without significant hull modification, another prohibitively expensive aspect. Modified 5” guns were proposed as a potential gap filler for the near term with the logic that any improvement was substantial compared to existing capability. This is probably the “event” that eventually generated a funded NSFS Program.

Chief of Naval Operations Executive Board (CEB). ***Naval Surface Fire Support.*** A briefing

provided to the Chief of Naval Operations by the Director, Surface Warfare (N86) and Director Expeditionary Warfare (N85). 14 December 1994. This was the follow-up to the 3 October 1994 CEB.

Commander in Chief, Atlantic Fleet (CINCLANTFLT). ***Assessment on NSFS***. November 1995. A classic example of the increasing role war fighters are playing in the requirements and acquisition process. This brief was provided to RADM Murphy, at the time, Commander, Destroyer Group Eight and chairing CINCLANTFLT's preliminary assessment of key Fleet issues to address during the 1995 Joint Requirements Oversight Council (JROC). RADM Murphy is currently OPNAV N86. This assessment provides an enlightening contrast between the perspectives of what the fleet considered as the baseline NSFS requirement and what OPNAV actually proposed to the CNO.

Department of the Navy. ***“Response to Questions from Mr. Bill Fallon, Military Liaison Attaché for Representative Dornan (R-Ca)”*** regarding the viability of returning battleships to active status to provide NSFS.” October, 1995.

Deputy Chief of Staff for Plans, Policy, and Operations, USMC and Deputy Chief of Staff for Operations and Plans, USA. Memorandum of Agreement (MOA). subject: ***Memorandum of Agreement between the United States Army and the United States Marine Corps; Army Multiple Launch Rocket System (MLRS) support to the Marine Corps***. 26 May 1995. The Marine Corps and Army agreed that the Army can provide MLRS support to augment Marine Corps artillery.

Director, Requirements and Advanced Systems Division, Center for Naval Analyses. Letter to Major General Harry W. Jenkins, Jr., Director, Expeditionary Warfare Division (N85) and others. CNA 93-2558. Subject: ***Guns, Missiles and Clubs***. 15 December 1993.

Draper Laboratory. ***Extended Range Guided Munitions (ERGM) “Red Team” Assessment***. November 95. The riskiest aspect of the ERGM resides in trying to miniaturize a GPS/INS package so that it can fit in a 5” gun projectile. NAVSEA considered the risk acceptable and recommended development. However, the Assistant Secretary of the Navy for Research Development and Acquisition (ASN(RD&A)) directed a “third party” risk assessment, in this case Draper Labs. Draper concluded that the risk was acceptable and recommended that the program proceed. This assessment lends credibility to the viability of the ERGM concept.

John Hopkins Applied Physics Laboratory (JHU/APL). ***NSFS Road Map Study Phase 1***. Status brief provided to OPNAV sponsors. April 1996.

JHU/APL. ***NSFS Road Map Study Status Brief to Jean Reed***. Brief provided to Jean Reed, Congressional Staffer and OPNAV sponsors. 8 October 1996.

JHU/APL. ***NSFS Road Map Study Status Brief to Naval Doctrine Command***. Brief provided to Naval Doctrine Command. 13 November 1996.

Laughlin, J.P., Vice President, Deep Attack Programs, Loral Vought Systems letter to Vice Admiral T.J. Lopez, Deputy Chief of Naval Operations for Resources, Warfare Requirements

and Assessments (OPNAV N8). 26 March 1996. This letter is a good source for a quick overview of the two recent ATACMS demonstrations performed to show the viability of a “sea-based” ATACMS capability.

Loral Vought Systems. ***Joint Power Projection2.NAVY TACMS2.From the Sea.*** A brief provided to OPNAV N85, 15 August 1995. This brief provides some basic technical information on a sea-based ATACMS capability.

Naval Surface Warfare Center (NSWC), Dahlgren Division. ***CJTFFEX NSFS Digitization Demonstration Report.*** 28 August 1996. In May 1996, in conjunction with Combined Joint Task Forces Exercise (CJTFFEX) 96 conducted off Camp Lejeune, NSWC demonstrated the feasibility of providing an automated targeting interface to an NSFS ship from a Forward Observer (FO) very similar in concept to the way artillery FOs are currently linked to artillery battery’s. This report emphasizes the need to acquire a target acquisition capability on par with the accuracy of the ERGM.

NAVSEA Program Manager (PMS 429). ***Naval Surface Fire Support: Program Overview.*** Brief to Lieutenant General Paul K. Van Riper, Commanding General, Marine Corps Combat Development Command and Major General Hanlon, Director, Expeditionary Warfare Division (N85), OPNAV. 7 Oct 1996. PMS 429 at the direction of OPNAV frequently provides this brief on a regular basis to keep decision makers abreast of progress. These briefs are helpful in determining to what degree Navy acquisition specialists and programmers are fulfilling NSFS requirements.

NAVSEA Program Manager (PMS 429). ***Naval Surface Fire Support: Where We Are. Where We’re Going. Dr. Paris Genalis and Mr. George Kopcsak.*** Program brief to Dr. Genalis and Mr. Kopcsak, Office of the Secretary of the Navy (OSD). August 1996.

OPNAV N85. ***ATACMS Advanced Technology Demonstration (ATD).*** 14 February 1994. A point paper describing the launch of a modified ATACMS mounted on the flight deck of the *USS Mount Vernon* (LSD-36). The ATACMS successfully engaged a land target approximately 75NM away on San Clemente Island. The details of the demonstration are included in this brief and reinforce the potential suitability of ATACMS in a NSFS role.

OPNAV N86. ***Interdiction from the Sea in support of Maritime Operations.*** August 1996. A draft point paper written for the 1996 Joint War Fighting Capabilities Assessment (JWCA). This particular process proposed two programming alternatives: (1) maintain the status quo and field a relatively limited ERGM capability, or (2) proceed with an expanded ERGM “buy” and NSFS missile development.

OPNAV N86. ***Chronology of Major NSFS Events.*** An abbreviated point paper that describes the genesis of key events that occurred in the development of the current NSFS Program. December 1995. This document was very helpful in comprehending the sequence and relationship of studies or reports and consequent developmental decisions. A more detailed and updated version of this chronology is included as Appendix D to this paper.

OPNAV N863. *Naval Surface Fire Support*. A brief to the Ground Maneuver Joint Warfare Capabilities Assessment (JWCA). 21 December 1994.

Vice President - Deep Attack Programs, Lockheed Martin Vought Systems LVS. Letter to Director Expeditionary Warfare (N85). Subject: *ATACMS VLS Demonstration*. 11 December 1996. This letter summarizes the successful firing of an ATACMS out of the Navy's Vertical Launch System (VLS). This was a "follow-up" to deck launched demonstration in February 1995 off the *USS Mount Vernon*. It resolved the major point of contention surrounding the use of a sea based ATACMS variant, i.e., whether or not it would fit in and fire from the Navy's existing VLS. Other missile candidates like Sea SLAM and Standard Missile have not yet undergone the rigorous testing ATACMS has. This may account for the receptiveness ATACMS currently enjoys within the NSFS arena.

D. REQUIREMENTS. The following documents capture the essential capabilities required of NSFS in support of OMFTS.

Chief of Naval Operations (N8). *Operational Requirements Document (ORD) for 5"/62 MK Gun Mount Modification (MK 45 Mod)*. 8 November 1995. This document describes the "gun mount" portion of the two major components that make up the near term NSFS Program. The other component is the projectile, or ERGM. Unlike the precision guidance associated with the ERGM, the modifications for the gun are relatively simple or low risk and cheaper than a "new" system. The DDG-51 Class Destroyer, which is still in production, provides both a suitable platform for the improved gun and an economical means to install the modification while the ship is still on the production line. Other desired ERGM characteristics are covered in this document including susceptibility to jamming, "minimum" ranges, and lethality.

Chief of Naval Operations (N8). *Operational Requirements Document (ORD) for Extended Range Guided Munitions (ERGM)*. 8 November 1995. This is the second major component of the near term NSFS Program. Risk was assessed as medium to low for the miniaturization of the GPS/INS core of the projectile. See Draper Laboratory's *Extended Range Guided Munitions (ERGM) "Red Team" Assessment*.

Commanding General, Marine Corps Combat Development Command (MCCDC). Position paper developed to articulate the Marine Corps' near term NSFS requirement. C445. Subject: *The Marine Corps Requirement for Naval Surface Fire Support (NSFS)*. 3 November 1994.

Commanding General, MCCDC. Letter to OPNAV N85, Director, Expeditionary Warfare (N85) and Director, Surface Warfare (N86). 3900 over C44. Subject: *Naval Surface Fire Support for Operational Maneuver from the Sea*. 3 December 1996. This letter formally expands upon the previous "*Near-term USMC NSFS Requirement*" of 3 November 1994 by emphasizing C2 connectivity, sea-based target acquisition, and re-emphasis on a NSFS weapon system capability on par with artillery.

Department of the Army. *Draft Operational Requirements Document for the Lightweight Laser Designator/Range-finder (LLDR)*. MCCDC, Quantico, VA. November 1996.

It describes the required capabilities of an organic, man-portable target acquisition system the Marine Corps plans to purchase in conjunction with the Army. The LLDR is a significant improvement, but it is not ideal for the ERGM. This document appears to demonstrate the incongruity that seems to naturally result from two separate services developing programs that are presumed to be mutually supporting.

Headquarters, U.S. Marine Corps. *Mission Need Statement (MNS) for NSFS* (Note: This document is classified Confidential, however the information used in this bibliography and elsewhere in this paper was exclusively extracted from sections clearly marked as unclassified.”). May 1992. The MNS articulates the requirement for NSFS within the context of OTH operations. The NSFS MNS serves as the baseline “requirements” document for the NSFS program within the acquisition process.

MCCDC, Requirements Division. *Near-term USMC NSFS Requirement*. 3 November 94. Developed by MCCDC for the 14 December CEB and subsequently approved by the CNO. This document stipulates an effectiveness on par with artillery and further specified a minimum threshold range of 41 NM and an objective range of 63 NM.

E. PROGRAM DOCUMENTATION. Program documentation provides an indication of how well previous decisions were translated into acquisition.

Chief of Naval Operations (N86). Letter to Commander, NAVSEA. 3330 Ser N863F/5U657542. Subject: *NSFS Program Guidance*, 18 January 1995. N86, the OPNAV NSFS resource sponsor, drafted this letter to NAVSEA in response to the CNO’s guidance provided during the 14 December 1994 CEB.

Commander, Dahlgren Division, Naval Surface Warfare Center. Letter to Commander, Naval Sea Systems Command. 8030 G307-JGP. Subject: *Release of 5-inch Gun Ammunition Performance Data to Center for Naval Analysis* (actually Analyses). 30 May 1995.

F. DOCTRINE. Doctrine provides a means with which to evaluate how well actual NSFS capabilities conform to OMFTS.

Clinton, William J., President of the United States. *A National Security Strategic of*

Engagement and Enlargement. Washington DC: U.S. Government Printing Office, February 1996.

Commander, Surface Warfare Development Group. Draft TACMEMO PZ1057-1-96. ***Over the Horizon Surface Amphibious Operations.*** Naval Amphibious Base, Little Creek, Virginia. 21 February 1996.

Department of the Navy (DoN). ***Forward From the Sea (FFTS).*** Washington DC. No date provided. Considering the wording in the cover letter, FFTS was published sometime in the 1994 time frame. Unlike OMFTS, FFTS was signed by the Secretary of the Navy, the Chief of Naval Operations and the Commandant of the Marine Corps.

Department of the Navy (DoN) Naval Doctrine Publication 1. ***Naval Warfare.*** Washington DC. 28 March 1994.

Krulak, C.C., General, USMC, Commandant of the Marine Corps. ***Operational Maneuver From the Sea.*** Headquarters, Marine Corps, Washington DC. Summer 1996. Both a future warfighting concept and corresponding road map to get there.

Naval Doctrine Command (NDC). ***Naval Fires: A Fighting Concept For the 21st Century.*** Working draft. 24 September 1996. Describes the notional function of “naval fires” in support of a joint commanders campaign.

Shalikashvili, J.M., General, USA, Chairman of the Joint Chiefs of Staff. ***Joint Vision 2010: Force of the Future.*** July 1996. U.S. Marine Corps Command & Staff College Warfighting from the Sea Readings, Vol. II, AY96-97. 382-397.

U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5. ***Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century.*** Fort Monroe, VA: U.S. Army TRADOC, 1 August 1994.

U.S. Marine Corps. ***A Concept for Ship-to-Objective Maneuver.*** Draft Marine Corps concept paper. Mar 1996. U.S. Marine Corps Command & Staff College Warfighting from the Sea Readings, Vol. II, AY96-97. 111-134.

Van Riper, P. K., Lieutenant General, USMC, Commanding General, Marine Corps Combat Development Command (MCCDC). ***Operational Maneuver From the Sea (OMFTS).*** Quantico, Virginia. 28 August 1996.

2. SECONDARY SOURCES. One of the drawbacks in the analysis and development of NSFS is the difficulty in “quantifying” the “qualitative” nature of the psychological effects of fires. The following sources augment the scientific perspective of the primary sources mentioned previously by providing the “human element” so often ignored in the current

developmental process. The human element, in addition to providing a more holistic view of NSFS, may in part, explain current concerns over the viability of precision guidance.

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Strategic Assessment 1996: Elements of U. S. Power. U.S. Marine Corps Command & Staff College Strategic Level of War Required Readings, Vol. II, AY 1996-97, 1-34. Author not specified.

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Card, William A., Lieutenant Colonel, USMC to (via Banyan E-mail) Lieutenant Colonel John Favors, USMC. Subject: ***This is Naval Surface Fire Support***. 23 Dec 1996. Extracted from Surface Warfare Magazine. (undated).

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